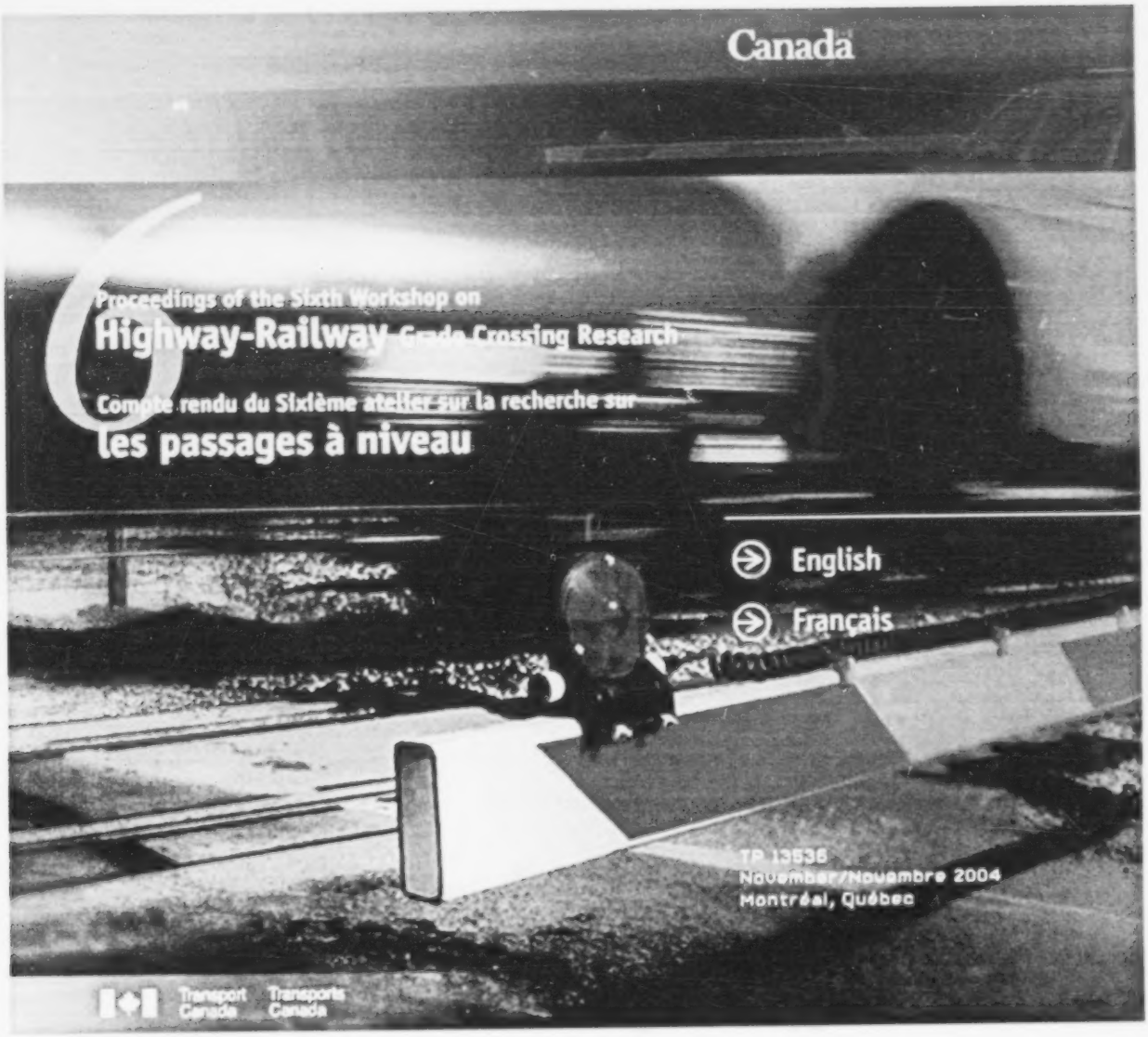
Canada
Proceedings of the Sixth Workshop on
Highway-Railway Grade Crossing Research
Compte rendu du Sixième atelier sur la recherche sur
les passages à niveau
English
Français
TP 13536
November/Novembre 2004
Montréal, Québec
Transport Canada
Transports Canada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16. Abstract

These proceedings contain the presentations given at the Sixth Workshop on Highway-Railway Grade Crossing Research held in Montreal, Quebec, 22-23 November 2004. The workshop was organized by members of the *Direction 2006* Research Committee. The presentations focus on research and development designed to improve highway-railway grade crossing safety. Abstracts are provided in both official languages.

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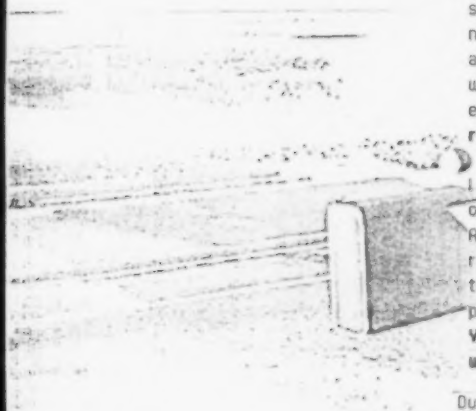
Canada

Welcome

Sesto Vespa
Chief, Technology Applications
Transportation Development Centre
Transport Canada
Montréal, Quebec



Ladies and gentlemen, hello and welcome. On behalf of the organizing committee, it gives me great pleasure to welcome you to Montréal to the Sixth Workshop on Highway-Railway Grade Crossing Research.

Let me first take this opportunity to thank each one of you for having made a personal commitment to do your share to improve public safety at grade crossings. It needs to be said, that the priority you give to this work and your willingness to share your experience with others will help make a difference in people's lives. That's why we enjoy this work!! **That's why we are on a mission rather than at a job!!**

I am happy to report that much has been accomplished over the last year, not just here in Canada and North America, but around the world. It's not just about the research that's been done! It's also about the efforts that have gone into bringing the research into daily practice, and bringing the benefits in as early as possible. **You will hear a little bit about this during our workshop sessions today and tomorrow.**

During the last year, here in Canada, we have completed a variety of research projects that have dealt with traditional technologies in new ways. We have addressed a number of issues dealing with locomotive horns, signal light technology, commercial vehicle drivers and heavy trucks, collision data warehousing and analysis, risk assessment, conspicuity of crossings and vehicles, second train event warning, and enforcement of crossing rules. **I invite you all to learn more about these activities by visiting our Web site at Transport Canada.**

The roundtable discussions that are integral to this Workshop will also allow all of us, collectively, to benefit from each one of you in guiding future initiatives. They will also help us in creating partnerships in areas of mutual interest so that we can pool knowledge, resources, and levers to tackle larger problems than would otherwise be possible and achieve more ambitious goals. **Mr. Bob Nash will be telling you about these roundtable sessions as soon as I get off this podium.**

However, before moving on, I would like to point to an overall perspective or theme that you will notice throughout the course of this workshop and, more generally, throughout the work that we do in this field, which is the vital link between human factors and technology.

We are very pleased with the record turnout at this year's workshop. Our team at Transport Canada's Transportation Development Centre and Rail Safety Directorate, as well as all our partners and stakeholders of Direction 2000, wish to **thank you for the excellent cooperation and partnerships that you have made possible and that have been instrumental in the** [illegible]

Enjoy and profit from the workshop, and enjoy our great host city of Montreal!

Have a great day!

Important Notices

105-06559/

The contents of these proceedings reflect the views of the speakers and not necessarily those of the sponsors.

The presentations and papers appear in the language in which they were delivered. Abstracts are provided in both official languages.

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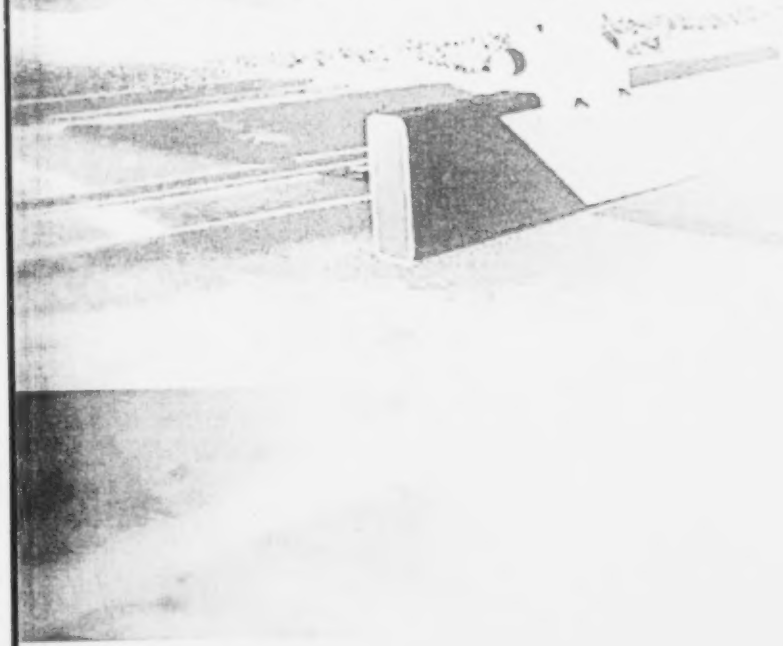

Table of Contents

Workshop Objectives
Robert Nash

1 **Photo Enforcement at Railway Level Crossings (Interim Status Report)**
G. W. English and J. Murdock

2 **Visual Behaviour and Conspicuity/Effectiveness of Grade Crossing Elements**
Alison Smiley

3 **Managing Risk Associated with Highway-Rail At-Grade Crossings**
Aidan Nelson

4 **Recent Advances in Highway Crosswalk Signalling and Their Potential Application to Rural Grade Crossings**
David Green

5 **Evaluating Safety Counter-measures at Highway-Railway Grade Crossings**
Frank Saccomanno and Peter Young-Jin Park

6 **Barlow Trail Rail Crossing Congestion Mitigation**
Doug Morgan

7 **Public Education and Enforcement Research Study**
Suzanne Sposato

8 **Critical Incident Stress Debriefing (CISD): Best Practices Study**
Michael Coplen

9 **Locomotive Horn Interim Final Rule**
Ronald E. Ries

10 **Grade Crossing Activities Update**
James A. Smalles

11 **Day 1 Closing Comments**
Daniel Lafontaine

12 **Understanding Train Suicides**
Brian L. Mishara

13 **Finding HRI Hot Spots: Issues and Practical Implications**
Liping Fu

14 **Protecting the Flow of Commerce**
Serge Meloche

15 **Day 2 Closing Comments**
Gary Drouin

16 **Workshop Wrap-Up**
Robert Nash

17 **Roundtable Discussions**

18 **Participants**

Workshop Objectives

Robert Nash
General Manager
Signals and Communications
Canadian Pacific Railway
Calgary, Alberta

Welcome to Montreal, ladies and gentlemen, to this our Sixth Annual Workshop on Highway-Railway Grade Crossing Research.

We have a full day and a half agenda this year, thanks to the popularity of last year's workshop, and the comments received from those attending.

The Research KRA (or key results area) Committee is part of Direction 2006, which is a partnership effort between government, the railway industry, municipalities, and other stakeholders with a mission to reduce highway-railway grade crossing collisions and trespassing incidents by 50 percent by the year 2006.

Your Research KRA has been working hard this past year, as you will see from the presentations given over the next day and a half.

The objectives of this year's workshop are similar to those in past years, where we want to:

1. provide you with an update on the results of the Research KRA's activities this past year,
2. provide you with an opportunity to hear about other research going on in the industry,
3. hear what our U.S. neighbours to the south are doing in terms of highway-railway grade crossing and trespassing research, and
4. provide you with an opportunity to input into future research activities through four interactive theme discussions, known as roundtable discussions.

This year we again have sponsors for our reception event this evening in La Terrasse (Delta mezzanine level). I would like to recognize:

- 3M
- Quixote
- PHW
- GELcore
- Carmanah Technologies

for their generosity and support of this event.

Direction 2006 is also providing presenter gifts. We have one for each of our presenters, as a small token of our appreciation.

I would also like to thank:

- CPR
- CN
- VIA
- Operation Lifesaver

for providing great gifts for our three raffles to be held throughout the next day and a half.

I would also like to thank D2006 for the attendee bags given out at registration.

The research team has put together a great learning experience for you, but the true success of this workshop can only be measured by your participation and the research ideas generated, which when put into action, will help move us closer to achieving our goal of reducing highway-railway grade crossing accidents and trespassing incidents.

Thank you, and enjoy the workshop!

Photo Enforcement at Railway Level Crossings (Interim Status Report)

G.W. English and J. Murdock
TranSys Research Ltd., Kingston, Ontario, Canada

Abstract

This presentation provides an interim status report on an ongoing project whose objective is to investigate, demonstrate and evaluate the effectiveness of automated photo enforcement technologies in improving grade crossing safety. It is the first application of photo enforcement technology to railway grade crossings in Canada.

In many of the previous international pilot projects at railway crossings, conventional highway intersection red-light-running technology has been transferred to a grade crossing application without change. This has not posed a problem for those installations that involve gates or conventional highway signals.

For this study, however, a non-gated crossing with a flashing-lights-and-bell (FLB) warning system was selected on Canadian National Railway's crossing of Range Road 232 in Strathcona County, Alberta. A non-gated crossing introduces an additional

opportunity to influence safe driver behaviour, but also makes more demands on the wording of the laws being enforced and on the technology used for auto enforcement.

Photo Enforcement at Railway Level Crossings
(Interim Status Report)

G.W. English and J. Murdock
TranSys Research Ltd

Sixth Annual Workshop on Highway-Railway Grade Crossing Research
(a Direction 2006 initiative)

Photo Enforcement Study

Objective

To investigate, demonstrate and evaluate the **effectiveness** of automated photo enforcement technologies in **improving grade crossing safety**.

Photo Enforcement

- **Background**
- Pilot Test Site
- Issues Involved
- Preliminary Insights from the Data

Background

- Widely Used for Highway Traffic Violations
- Limited Application at Railway Level Crossings
  - mostly at gated crossings
- This Project Is the First Application at a Railway Crossing in Canada

Metro Blue Line in Los Angeles
(New Street-Car Line in 1990)

- Partially shared right of way with freight trains
- First three years of operation had 20 vehicle-train collisions and 4 occupant fatalities at its 23 gated crossings.
- Photo enforcement was assessed and subsequently installed at 19 crossings.

TranSys Research Ltd

Photo Credit: ACS

Frequent Problem
Left Turn Geometry

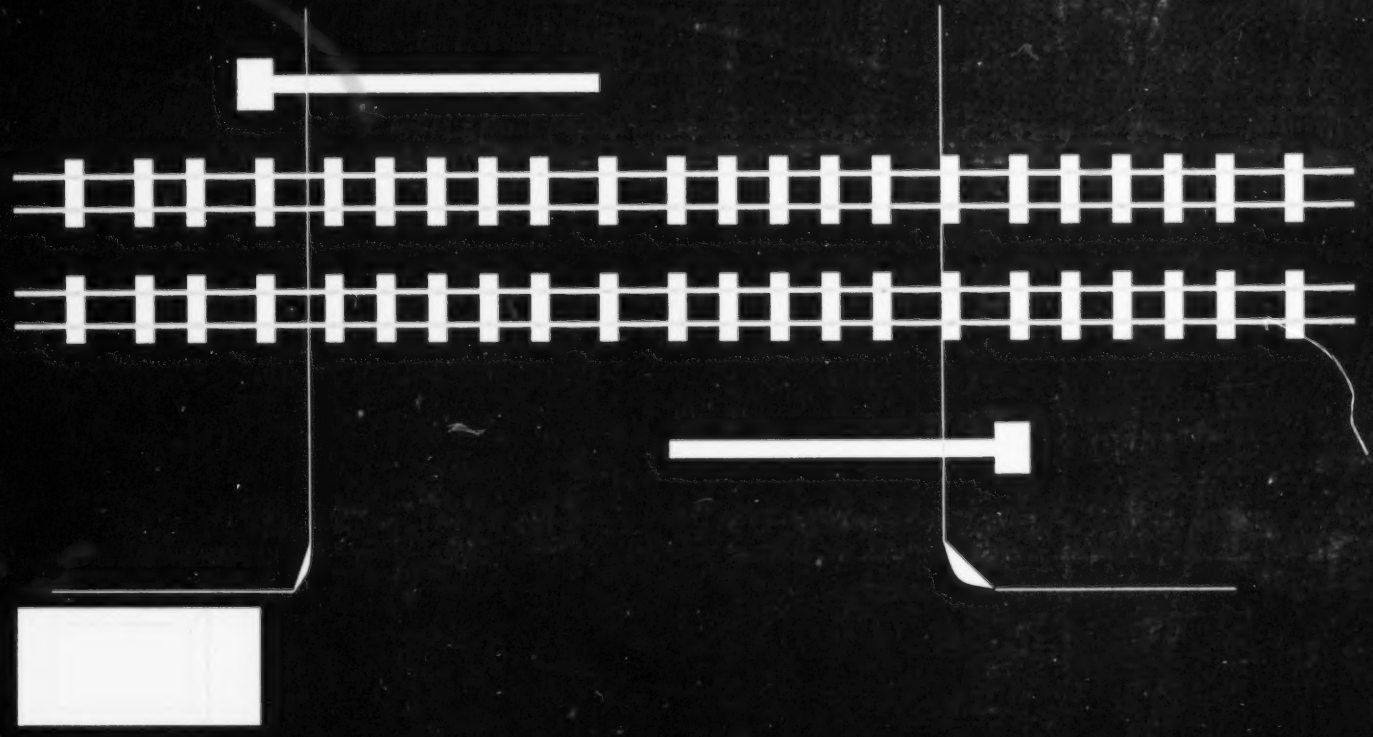

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Photo Enforcement

- Background
- **Pilot Test Site**
- Issues Involved
- Preliminary Insights from the Data

Strathcona County RR-232 and CN's Wainwright Subdivision

- 1,200 highway vehicles/day/direction
- 20 trains per day
  - (passenger, freight and local switchers)
- Non-Gated FLB crossing
- Fixed Distance Track Circuits for Train Detection

Strathcona County Installation

- Industrial Feeder Road
- Railway Switching Operations One Side, Junction on the Other Side

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Strathcona County Installation

Pilot Project Involved an Awareness Campaign

Warning Citations Initiated November 1, 2004

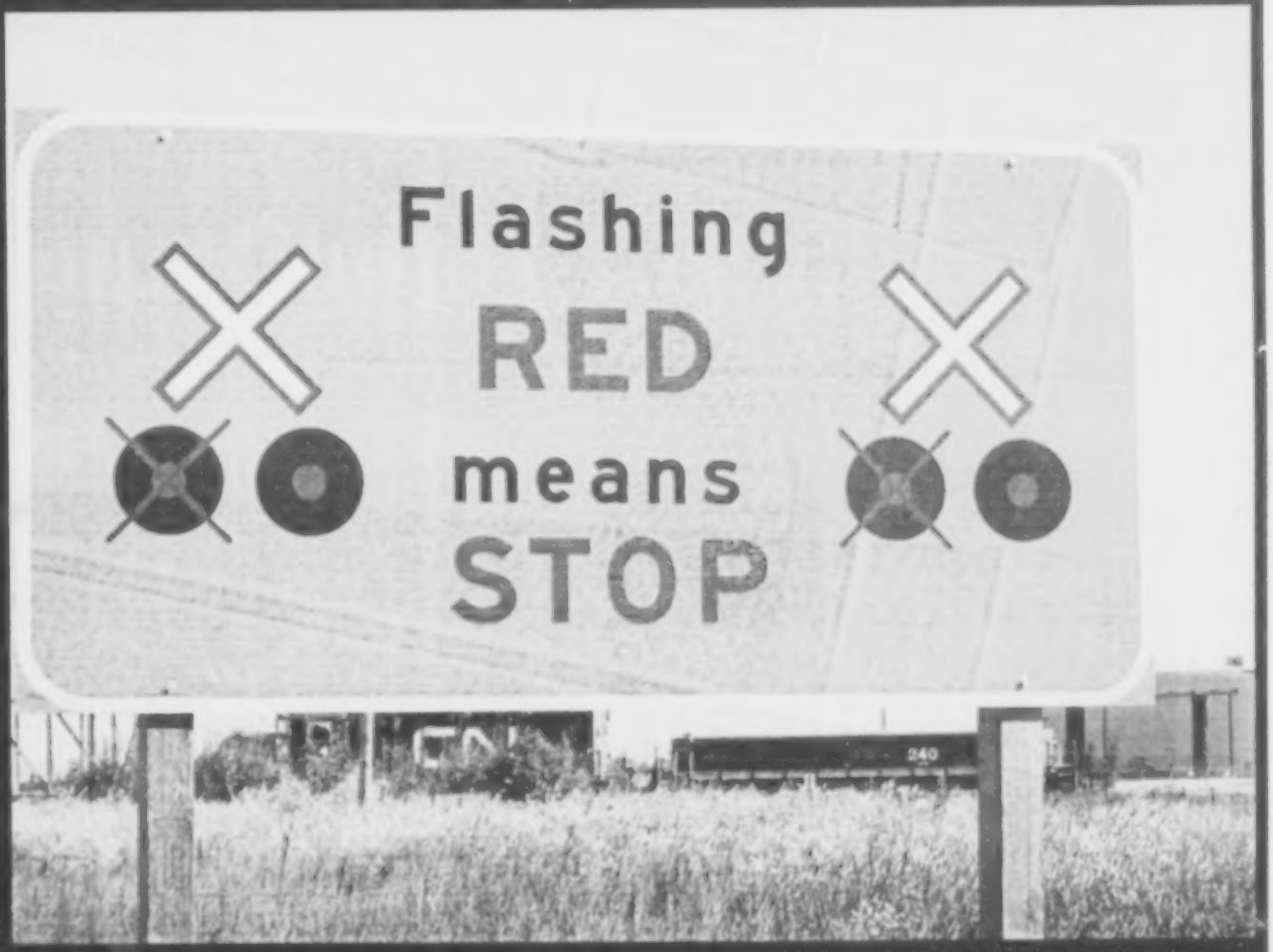

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Photo Enforcement

- Background
- Pilot Test Site
- **Issues Involved**
- Preliminary Insights from the Data

The Problem

- An **Ideal Warning** System Provides a Warning **when Danger is Present**
- Normal and Necessary Railway Operations In Urban Areas often Preclude the Ideal
- **Level Crossing Warning** Systems with Fixed Distance Track Circuits Provide an Indication that **Danger Might be Near**

The Opportunity

- Engineering Changes Can Produce Improvements for Some Scenarios
  - Gates are Relatively Inexpensive, but Don't Address the Root Problem of Warning Time Variability
  - Train Speed Predictors and Motion Sensors can Reduce Warning Time Variability, but are Relatively Expensive and are Still Influenced by Train Switching Operations
- Can Photo Enforcement Influence Safe Behaviour as a Cost Effective Alternative?

The Constraints

For Enforcement To Enhance Safety:

- The Laws Being Enforced Must Promote Safe Behaviour
- The Enforcer Must Detect and Respond to Unsafe Behaviour

Flashing Red Light
(Highway Regulations)

Drivers:

a) **shall stop** the vehicle, and

b) **shall not drive** the vehicle into the intersection so that the vehicle or any portion of the vehicle is in the intersection **until it is safe to do so.**

Stop Sign Regulations

(Railway Crossings with Stop Signs)

Drivers:

a) **shall stop** the vehicle no closer than 5 metres and no further than 15 metres back from the nearest rail of the railway, and

b) **shall not proceed** to drive the vehicle across the railway crossing until the vehicle **can be driven in safety** across the railway crossing.

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Railway Crossing Regulations (other than stop signs)

When a train is approaching, drivers:

a) **shall stop** the vehicle no closer than 5 metres back from the nearest rail of the railway, and

b) **shall not proceed** to drive the vehicle across the railway crossing **until the train has passed** by the railway crossing **or has come to a stop and the vehicle can be driven in safety** across the railway crossing.

Regulation Wording Constraints

- Part b) Associates Certain Conditions With Safely Proceeding,
- Stopped or Passed Train Conditions Might Have Been Adequate for Passive Warning Signs at Single Track Crossings, but Both Situations Can Be Very Dangerous for Double Track Lines.

Regulation Wording Constraints

- Conversely, Proceeding Under Clearly Safe Conditions Can Be a Violation, Since One of the Definitions of an "Approaching Train" is an Activated Warning System.
- The Regulation Wording Used for Stop Signs at Railway Crossings has Advantages.

Regulation Wording Constraints (Dilemma Interval)

Application of Automatic Enforcement Systems at Railway Crossings Needs to Address the Dilemma Period that Exists at the Onset of the Warning (Addressed With a Yellow Light at Highway Intersections and some European Railway Warning Systems)

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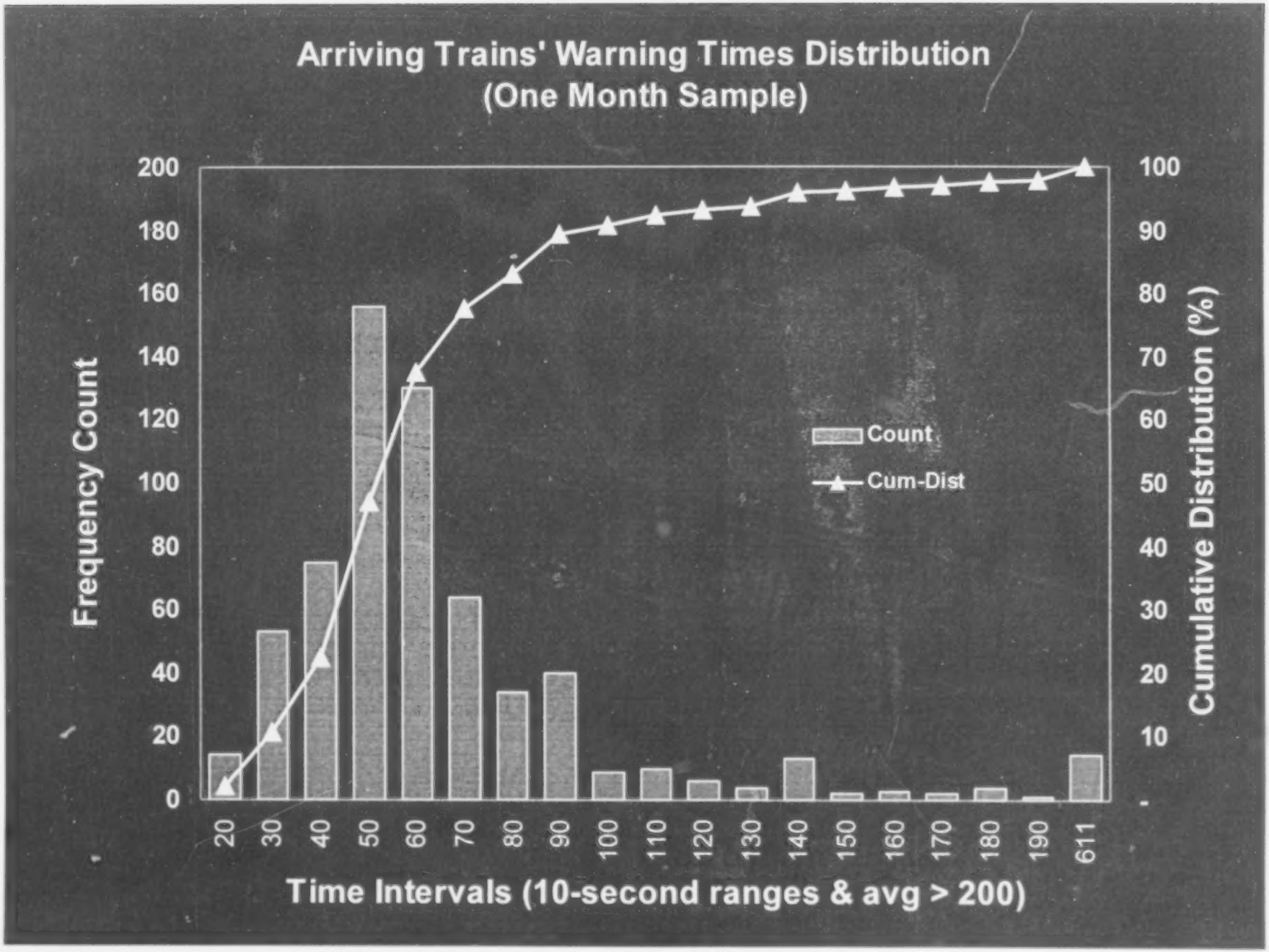
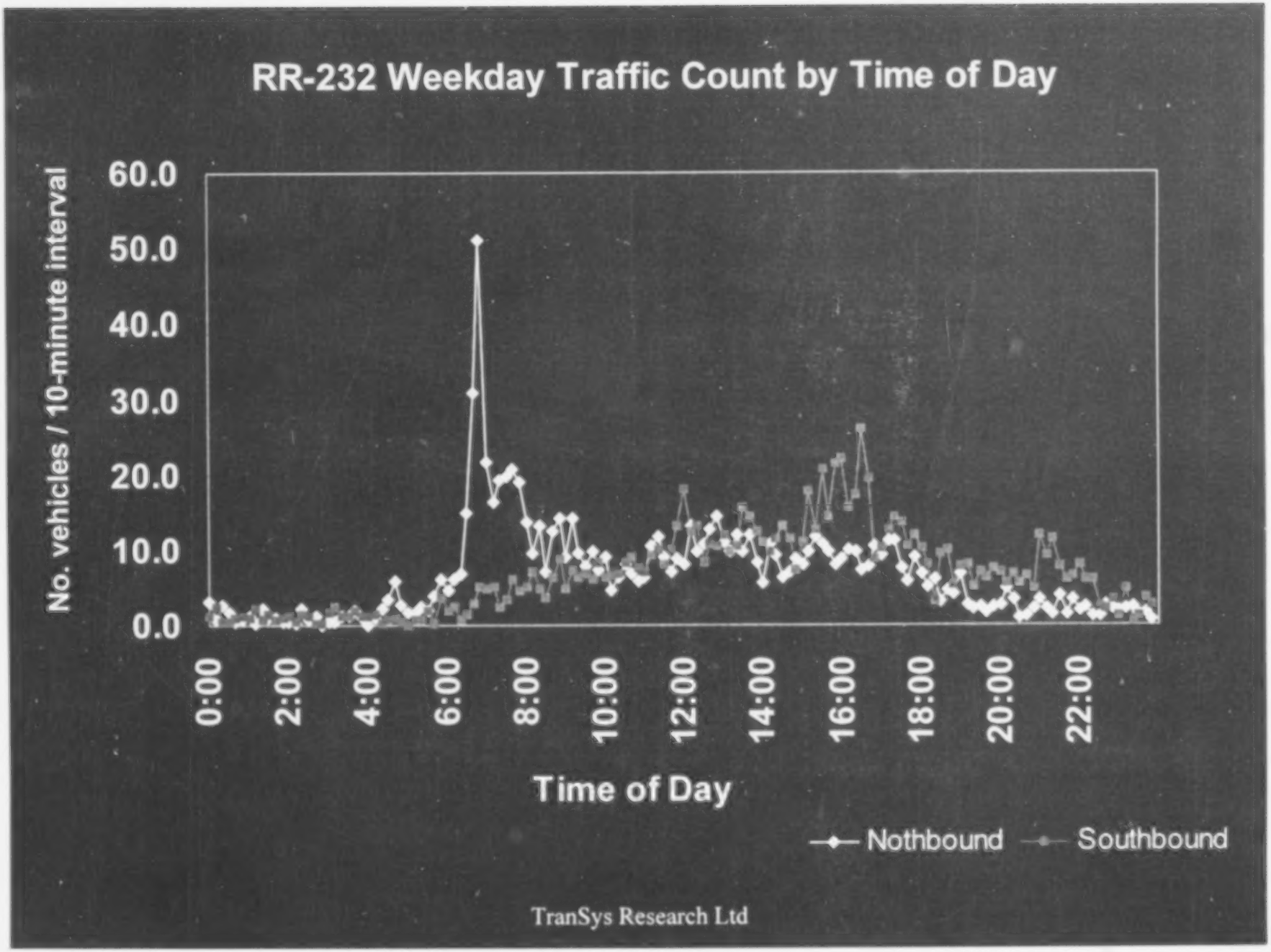
Photo Enforcement

- Background
- Pilot Test Site
- Issues Involved
- **Preliminary Insights:**
  - Warning System Characteristics
  - Highway Traffic Characteristics
  - Driver Behaviour

Preliminary Insights From the Data

- Warning System Characteristics
- Highway Traffic Characteristics
- Driver Behaviour


Arriving Trains' Warning Times Distribution
(One Month Sample)
Frequency Count
Cumulative Distribution (%)
Count
Cum-Dist
0
20
40
60
80
100
120
140
160
180
200
-
10
20
30
40
50
60
70
80
90
100
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
611
Time Intervals (10-second ranges & avg > 200)


RR-232 Weekday Traffic Count by Time of Day
No. vehicles / 10-minute interval
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Time of Day
Nothbound
Southbound
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Non-Stopping Violations

visible but non-operational photo enforcement

(one-month sample)

Warning Time Range	Number of Trains	Expected # Hwy Vehicles	Number Non-Stop Violations	Proportion Not Stopping
<30	11	7	0	0.0%
30 – 40	49	37	2	5.5%
40 – 50	69	56	2	3.6%
50 – 60	138	158	13	8.2%
60 – 70	117	130	15	11.5%
70 – 80	61	104	13	12.6%
80 – 90	32	49	9	18.6%
> 90	101	419	24	5.7%
Total / Avg	578	958	78	8.1%

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Risk Taking / Clearance Time

(Hwy Vehicle Exit to Train Arrival, 1 Month Sample)

Clearance Time (sec)	Number of Non-Stop Violations	Number of Stop and Go Violations (est.)
<10	0	0
10 - 20	8	16
20 - 30	12	24
30 - 40	13	26
40 - 50	14	28
50 - 60	6	12
60 - 70	4	8
70 - 80	2	4
80 - 90	2	4
> 90	17	77
Total	78	198

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Project Timeline (Remaining Tasks)

- Monitor the Safety Effectiveness of Warning Citations (Nov/Dec, 2004)
- Assess and Compare the Cost Effectiveness of Photo Enforcement with other Engineering Alternatives
- Project Completion Target (March, 2005)

Project Timeline (Remaining Tasks)

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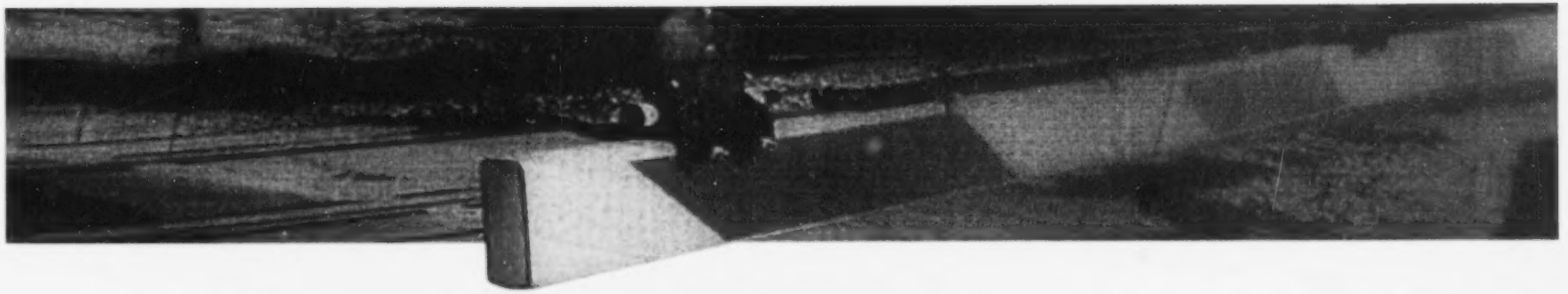


Visual Behaviour and Conspicuity/Effectiveness of Grade Crossing Elements

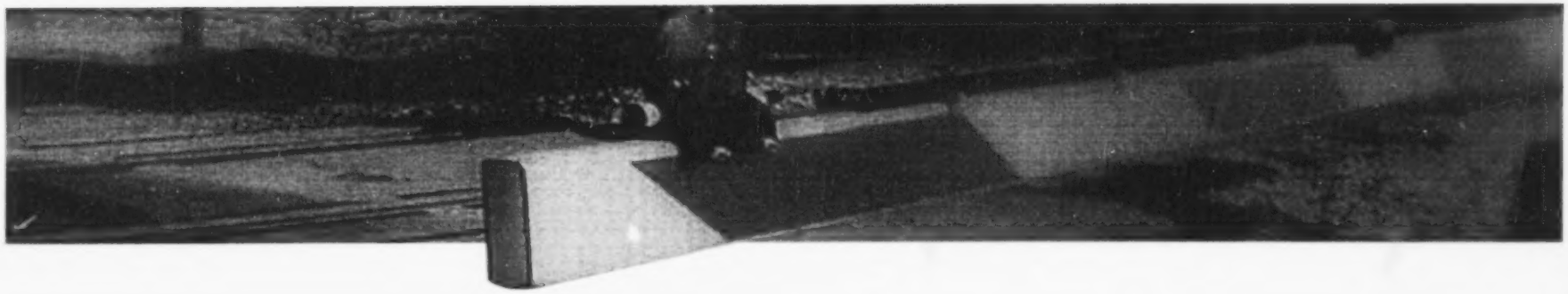
Alison Smiley
Human Factors North Inc., Toronto, Ontario, Canada

Abstract

Transport Canada has contracted Human Factors North Inc. and the University of Calgary to carry out a two-year investigation of driver visual behaviour in relation to the conspicuity and effectiveness of grade crossing elements. The objective of the project is to provide recommendations to improve the conspicuity, alerting capabilities, and safety effectiveness of various highway-railway grade crossing elements.

Phase I of this project is to critically review the literature on the effectiveness and conspicuity of grade crossing system elements in terms of visual behaviour and driver response.

Based on the literature review, in Phase II we will propose grade crossing elements most likely to be effective, and experimental methods for assessing their effectiveness. The most cost-effective combination of test methods (laboratory, simulator, and on-road testing) will be proposed.



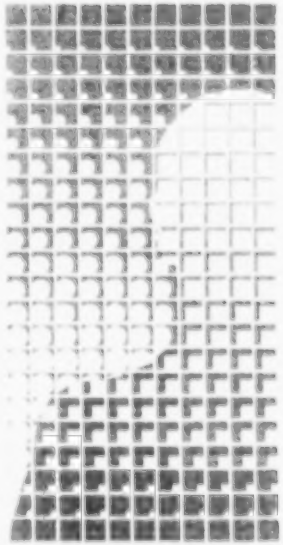
During Phase III we will use the protocol developed in Phase II to measure the performance of highway-railway grade crossing warning system elements under various test conditions. The focus of our efforts will be driver behaviour in relation to:

· Protected crossings:
  - Design and placement of flashing lights
  - Design of the crossbucks that differentiates protected and unprotected crossings

· Unprotected crossings:
  - Devices based on train movement to trigger illumination of the crossing
  - Effectiveness of signs: crossbucks, stop signs, yield signs, advance warning signs, multi-track signs
  - Rumble strips
  - Traffic calming on the approach
  - Pavement markings
  - Train light systems

In Phase IV, the results of the field test in Phase III and the literature review in Phase I will be used to develop an assessment tool for use at railway crossings to determine how likely the crossing elements present are to elicit safer human response/behaviour on the approach and while travelling over grade crossings.

VISUAL BEHAVIOUR AND CONSPICUITY/EFFECTIVENESS OF GRADE CROSSING ELEMENTS



HUMAN FACTORS NORTH

SIXTH ANNUAL WORKSHOP ON HIGHWAY-RAILWAY GRADE CROSSING RESEARCH
November 22, 2004

Alison Smiley, PhD, CCPE

PROJECT TEAM

HUMAN FACTORS NORTH INC.

- Alison Smiley, PhD, CCPE
- Dianne Davis, M.Eng.
- Tom Smahel, BASc

UNIVERSITY OF CALGARY

- Jeff Caird, PhD
- Don Kline, PhD

JOCK VALLEY ENGINEERING LTD.

- Bob Fish, P.Eng.

WORK PLAN

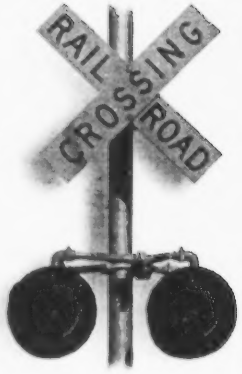
Phase I: Literature review – Oct. 2004 to Jan. 2005

Phase II: Protocol development – Jan. to June 2005

Phase III: Protocol implementation – June 2005 to July 2006

Phase IV: Assessment tool development – July to Sept. 2006

Phase V: Conclusions/recommendations – June to Dec. 2006



FOCUS OF CONTRACT

- Crossing type: Passive vs. activated (with and without barriers) crossings
- Specific accident type(s) to be addressed
- Driver vs. pedestrian response
- Visual behaviour vs. non-compliance
- New vs. existing devices
- Devices on trains vs. at crossings

TYPE OF CROSSING/CRASHES (1)

- Unprotected crossings:
  - ❖ Crossing and/or train are not detected due to:
    - Poor conspicuity of crossing elements
    - Poor visibility of train at dawn/dusk/night
    - Visual clutter due to commercial signs and driver distraction
    - Driver not realizing that the crossing is unprotected
    - Driver over-familiarity and not noticing the crossing or train
    - Visual search inadequate due to skew angle

TYPE OF CROSSING/CRASHES (2)

- Protected crossings:
  - Activated flashers not detected – daytime
    - Sun glare
    - Competition with other road task
  - Stopped train near signal is assumed to be cause of signal activation – second train arrives while vehicle crossing against flashers

TARGET POPULATIONS

- Drivers, not pedestrians
- Drivers of passenger and commercial vehicles
- Local and unfamiliar drivers
- Older drivers

BEHAVIOURS OF INTEREST

- Detection
- Visual search
- Compliance
- Understanding of appropriate response
- Estimation of train speed
- Expectation

DEVICES OF INTEREST

- Signs –
  - ❖ Crossbucks: colour, placement, distinction between protected and unprotected crossings
  - ❖ advance warning: STOP and YIELD signs, PREPARE TO STOP WHEN FLASHING signs, multiple tracks signs, signs with more specific warnings
- Signals – flashers (LEDs, flash rate, backboard, placement)
- Pavement markings and rumble strips
- Crossing illumination triggered by train movement
- Train – retro-reflective markings, ditch lighting

ENVIRONMENTS OF INTEREST

- Misleading cues (paved road, built-up area, but unprotected crossing)
- Skew (visual search difficulty)
- Clutter due to commercial advertising

PHASE I: LITERATURE REVIEW

- Human Factors Causes of Rail Crashes
- Driver Behavior at Highway-Railway Crossings
- Vision, Visual Loss and Conspicuity
- Laboratory Studies of Conspicuity of TCDs
- Countermeasures to Highway-Railway Crossing Accidents
- Recommended Crash Types and Methodology

PHASE II: PROTOCOL DEVELOPMENT

- Laboratory studies
- Simulator studies:
  - ❖ Determine crossing element conspicuity
- On-road studies:
  - ❖ Driver visual search, speed and compliance
- Ethics Committee review

LABORATORY STUDY: GOAL

- Determine relative conspicuity of:
  - ❖ Various crossing elements (e.g., crossbuck, pavement markings)
  - ❖ Crossing element features (e.g., yellow vs. black background to flashers, placement near lane centre vs. lane edge)
- Determine visual predictors of high vs. low conspicuity of a given element or feature

LABORATORY STUDY: MEASURES

- Attention conspicuity
- Search conspicuity
- Visual measures:
  - ❖ Visual acuity
  - ❖ Contrast sensitivity
  - ❖ Colour vision

ATTENTION VS. SEARCH CONSPICUITY

- Attention conspicuity (i.e., naïve driver)
  - ❖ What is noticed first?
  - ❖ How long did it take to notice it?
  - ❖ Why was it noticed?
  - ❖ What else is noticed?
- Search conspicuity (i.e., driver looking for crossing)
  - ❖ Is selected element (e.g., crossbucks) present/absent?
  - ❖ How long to make judgment?

LABORATORY STUDY: METHOD

- Assessment of static and perhaps dynamic crossing elements
- Using brief displays of wide-screen high-resolution digitized photographs of railroad crossings, and MPEG digital video for dynamic elements
- Presentations per subject: More if search vs. attention conspicuity
- Session length per subject approximately 1.5 hr., including informed consent, vision testing, experimental testing and debriefing protocols

LABORATORY STUDY: SAMPLE

- 36 – 72 subjects:
  - ❖ N dependent on use of within (driver cued – search conspicuity) vs. between (driver naïve – attention conspicuity) designs
- Young, middle-aged, old; half male, half female

LABORATORY STUDY: OUTCOMES (1)

- Knowledge about relative conspicuity of:
  - ❖ Individual crossing elements
  - ❖ Variations of individual crossing elements (e.g., in placement, size, temporal change, colour and luminance contrast)
  - ❖ Crossing element combinations
  - ❖ Interactions between crossing element and background (e.g., clutter/complexity, seasonal colour variation)

LABORATORY STUDY: OUTCOMES (2)

Determination of promising crossing elements that should be tested in simulator and on road

- Predictive relationships between vision test measures and element conspicuity for:
  - ❖ Drivers overall
  - ❖ Drivers with various visual limitations (e.g., colour vision deficiencies, poor contrast sensitivity)

SIMULATOR STUDY: GOAL

- Based on laboratory study, determine relative conspicuity of most effective:
  - ❖ Crossing elements (e.g., stop sign vs. crossbuck)
  - ❖ Crossing element features (e.g., yellow vs. black background to flashers)

  in a more realistic driving environment

SIMULATOR STUDY: METHOD

METHOD:

- Digital films of variety of train crossing approaches from driver's viewpoint
- New devices inserted into digital films

SAMPLE:

- 40 – 60 subjects
- Young, middle-aged, old
- Male, female

SIMULATOR STUDY: MEASURES

ATTENTION CONSPICUITY MEASURES:

- Time to detect presence of crossing (eye movements)
- Time to detect crossing elements (eye movements)
- Which element is detected first

VISUAL SEARCH MEASURES

- Timing and extent of search relative to crossing

SIMULATOR STUDY: OUTCOMES

OUTCOMES:

- In a more real-life setting, knowledge about relative conspicuity and visual search in response to:
  - ❖ Individual crossing elements
  - ❖ Variations of individual crossing elements
  - ❖ Crossing element combinations
  - ❖ Crossing elements that should be tested on-road

SIMULATOR STUDY: CONSIDERATIONS

- Attention conspicuity will limit presentations per subject
- Full simulation of railway crossing expensive
- Partial simulation using digital films of crossings with and without train present
- Accurate information on train movements from railways will be required to limit time to obtain digital films
- Use of eye movement equipment with digital films is new and will require re-calibration of recorder

ON-ROAD STUDY: DESIGN

POTENTIAL EXPERIMENTAL CONDITIONS:

- Protected with lights only vs. unprotected
- Skew
- Visually cluttered vs. uncluttered environment
- Competing driving task (e.g., intersection crossing)
- In environments with/without misleading cues
- With and without stop signs
- With and without train parked near multi-track crossing activating flashers
- New crossing elements

ON-ROAD STUDY: METHOD

METHOD:

- Observer and video camera(s)
- Interviews?

MEASURES:

- Visual search (daytime only)
- Speed at x metres from crossing
- Driver compliance in presence of train
- Time margin between vehicle and train crossing if non-compliant

SUBJECTS:

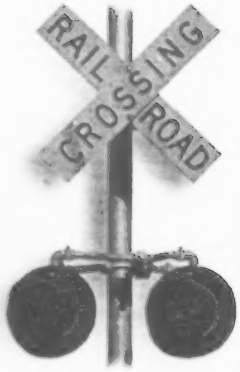
- 20 – 30 unaware drivers per crossing depending on volumes

ON-ROAD STUDY:OUTCOMES

OUTCOMES:

- In a naturalistic setting, knowledge about:
  - ❖ Driver visual search
  - ❖ Speed
  - ❖ Compliance
  - ❖ Comprehension

  with various combinations of crossing elements in various environments



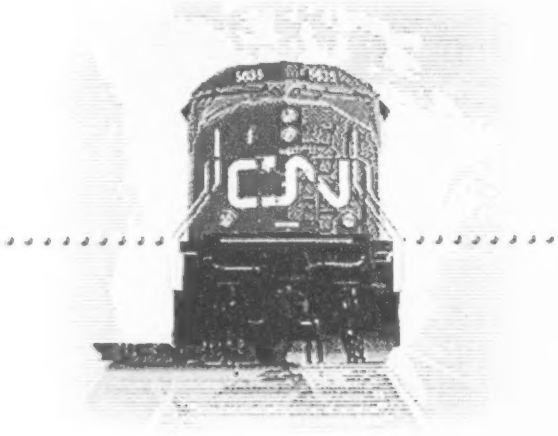
ON-ROAD STUDY: CONSIDERATIONS

- Unprotected crossings have low train and vehicle volumes necessitating long waits between drivers and even longer waits for drivers encountering a train
- In a naturalistic study only overt behaviour can be measured – not detection
- Unprotected crossings are generally in rural areas – selected crossings must allow observer to be hidden
- New devices will have novelty effect – behavioural adaptation must be considered

NEXT STEPS

- HFN Ethics Committee review
- Protocol implementation
- Assessment tool development
- Final report

RAIL
CROSSING
ROAD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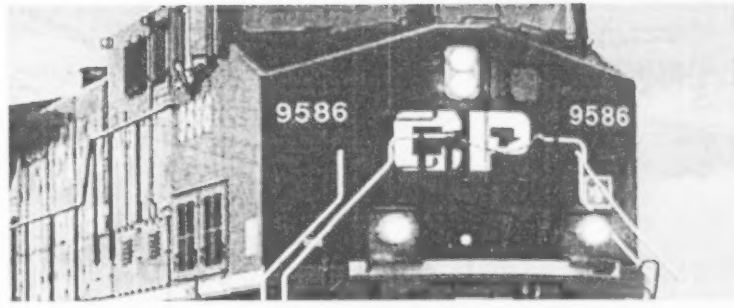
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Managing Risk Associated with Highway-Rail At-Grade Crossings

Aidan Nelson

Rail Safety and Standards Board, London, United Kingdom

Abstract

A catastrophic collision on a level crossing on 6 November 2004, in which the car driver, the train driver and five passengers were killed, substantially altered the context of this presentation, particularly as there has been extensive media speculation that the car driver was intent on suicide. Collisions on level crossings with such catastrophic consequences are rare and may have a disproportionate influence on work to ensure that cost, performance and safety remain in balance.

Level crossing risk is the single largest unmitigated train accident risk precursor on Britain's national rail network. In this presentation the composition of this risk to those on trains, in motor vehicles or as pedestrians is analysed, and the relative performance of the UK in a wider European context is discussed.

The presentation also covers the adoption in Britain of the Operation Lifesaver philosophy and the importance of ensuring that there is an enabling framework in which the

three strands of engineeering, education and enforcement are addressed. In turn, there needs to be an evaluation framework in place. Central to this is the work of the National Level Crossing Safety Group, formed in 2002.

An overview is given of the publicly funded safety research and development work in the field of level crossings managed by the Rail Safety and Standards Board, a brief analysis of the UK view on suicide and suspected suicide at level crossings is presented.

Managing risk associated with highway–rail at-grade crossings

Montreal
November 2004

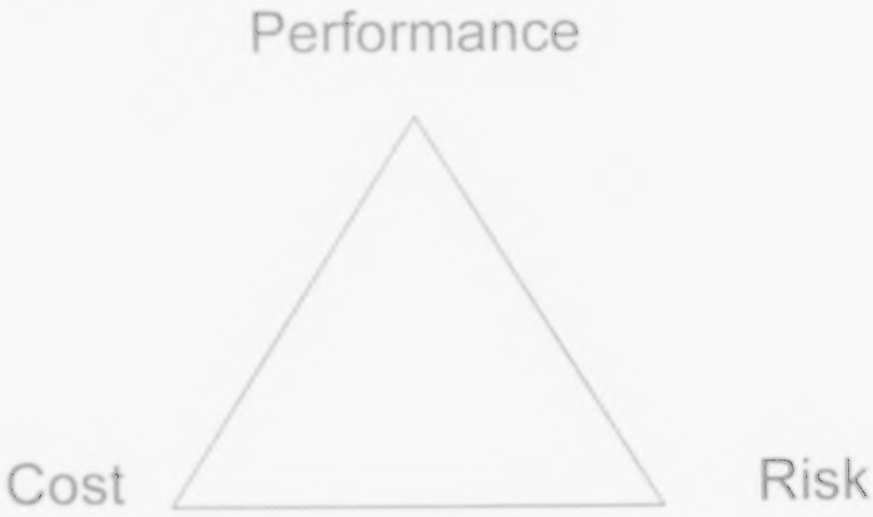
Aidan Nelson
Director, Policy & Strategic Initiatives

Catastrophic consequences

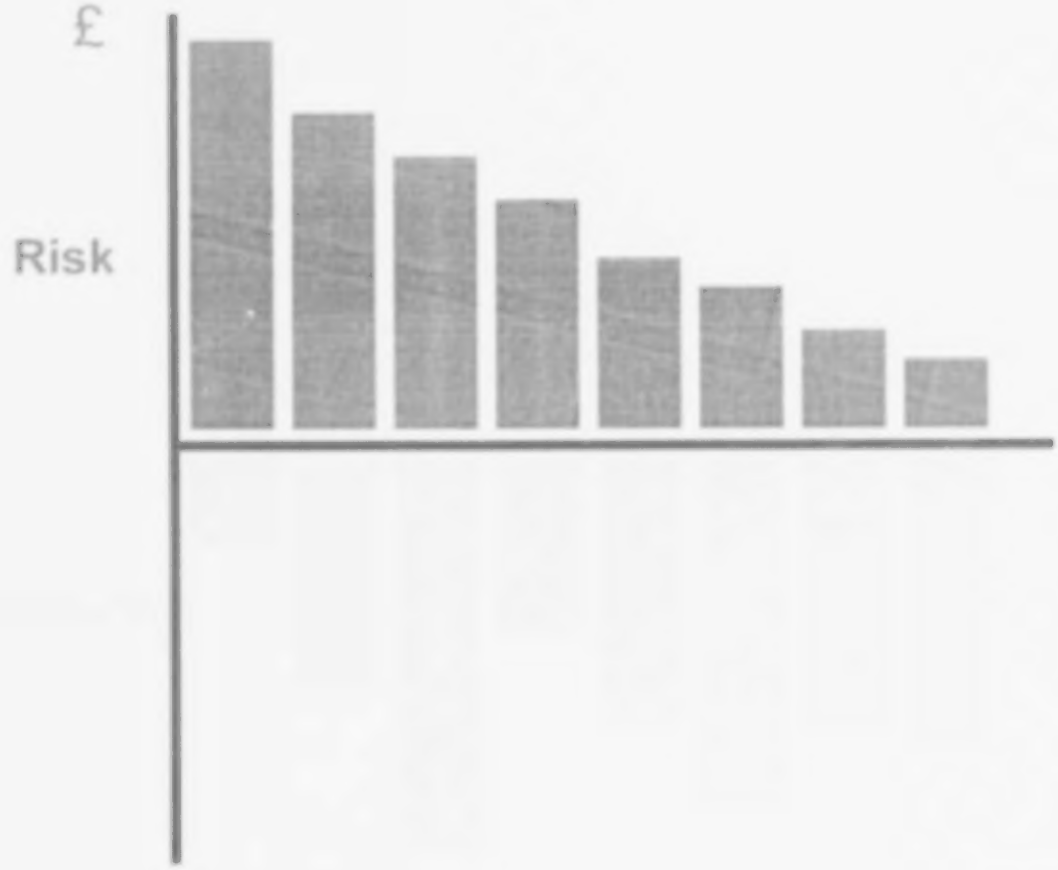
- Hixon, January 1968
  - A large slow moving vehicle
- Lockington, July 1986
  - A van
- Great Heck, February 2001
  - A Land Rover and trailer
- Ufton Nervet, November 2004
  - A saloon car

Main objective

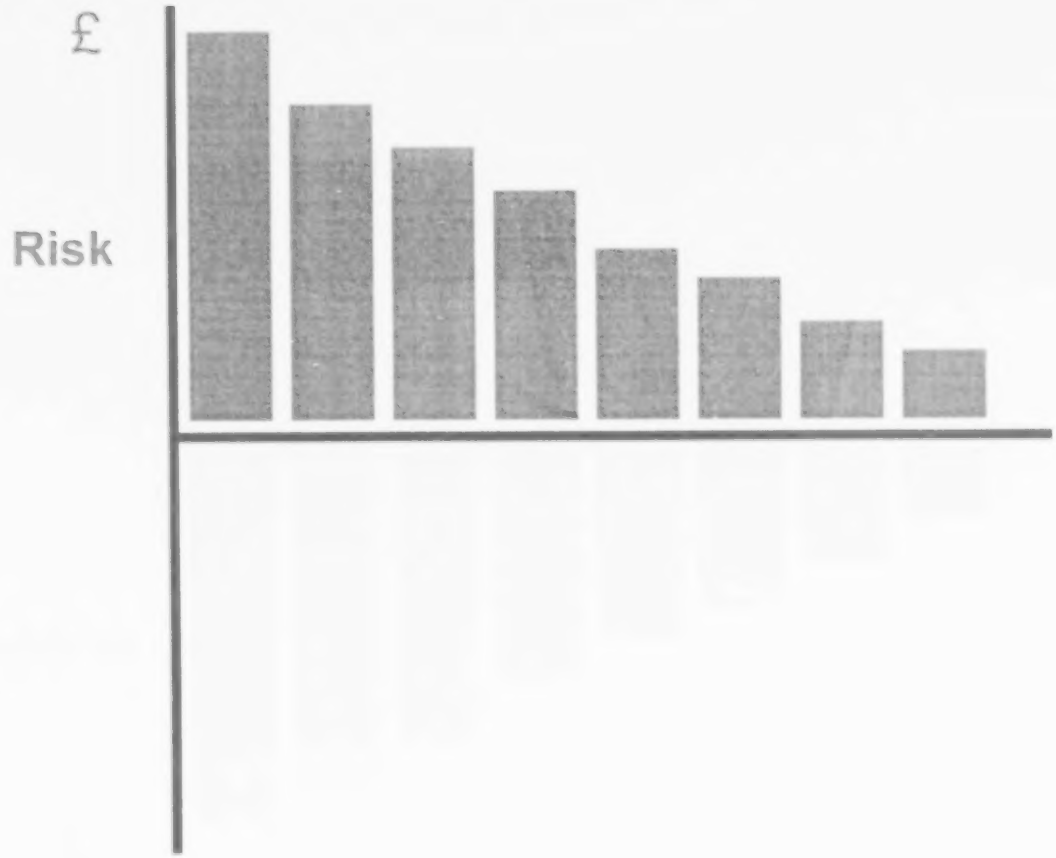
- Continuously find the optimum balance between cost & risk to safely optimise business performance



Cost / risk balance



Cost / risk balance



The UK risk context

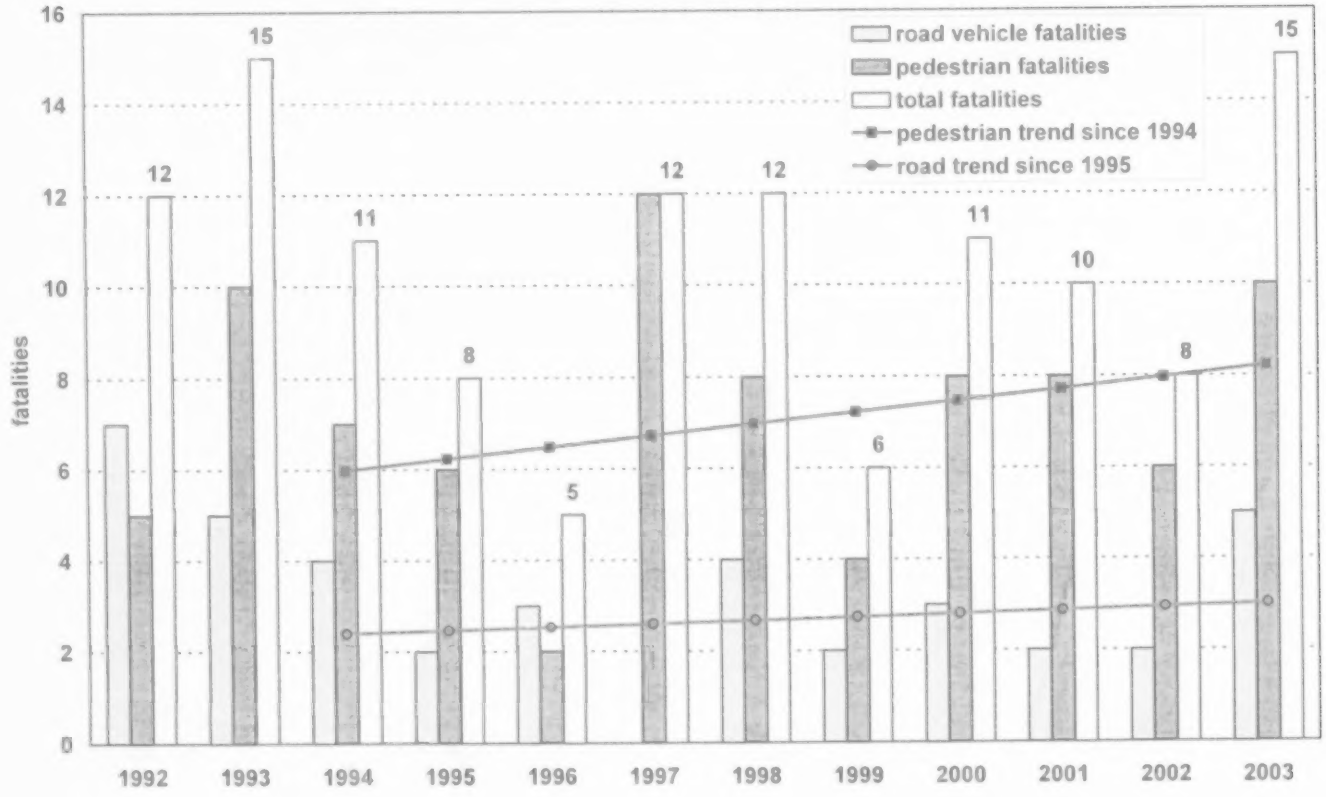
Risk Model Estimates of Annual Effective Fatalities at Level Crossings			
Pedestrians	Road Vehicle Users	Train Occupants	Total
7.75	2.45	2.0	12.2

The UK risk context

Risk Model Estimates of Annual Effective Fatalities at Level Crossings			
Pedestrians	Road Vehicle Users	Train Occupants	Total
7.75	2.45	2.0	12.2

Road vehicle & pedestrian casualties

Road vehicle occupant and pedestrian level crossing fatalities



European context

Country	No of Level Crossings (1998)	No of collisions (1996-2000)	No of road vehicle fatalities (1996-2000)
Belgium	2409	338	74
Finland	5283	238	53
France	19831	902	263
Germany	26980	2259	456
Ireland	1976	21	4
Luxemburg	149	10	4
Netherlands	3006	363	155
Norway	5090	63	19
Portugal*	2972	586	120
UK	8323	179	12
Total	76019	4959	1160

* figures for Portugal include estimates for 2000

Lifesaver philosophy

- *Education*: Increasing public awareness of the dangers of level crossings and educating pedestrians and road vehicle drivers how to use them correctly
- *Engineering*: The protection fitted to level crossings through lights, horns, barriers, telephones and signs together with research into other innovative means of increasing safety
- *Enforcement:* The use of laws to prosecute those who endanger themselves or others by misuse of crossings

and

- *Enabling*: The provision of resources through people, procedures and systems to allow the other 3Es to be effective

- Established in October 2002

NLXSG

National Level Crossing Safety Group

National Level Crossing Safety Group

The group is working to:

Raise the profile of level crossings in road vehicle driving examinations and handbooks.

Encourage research to understand user behaviour

Encourage more appropriate data collection

- establishment of a national level crossing database

Raise awareness within the judiciary

Promote deterrent measures

Consider media campaigns

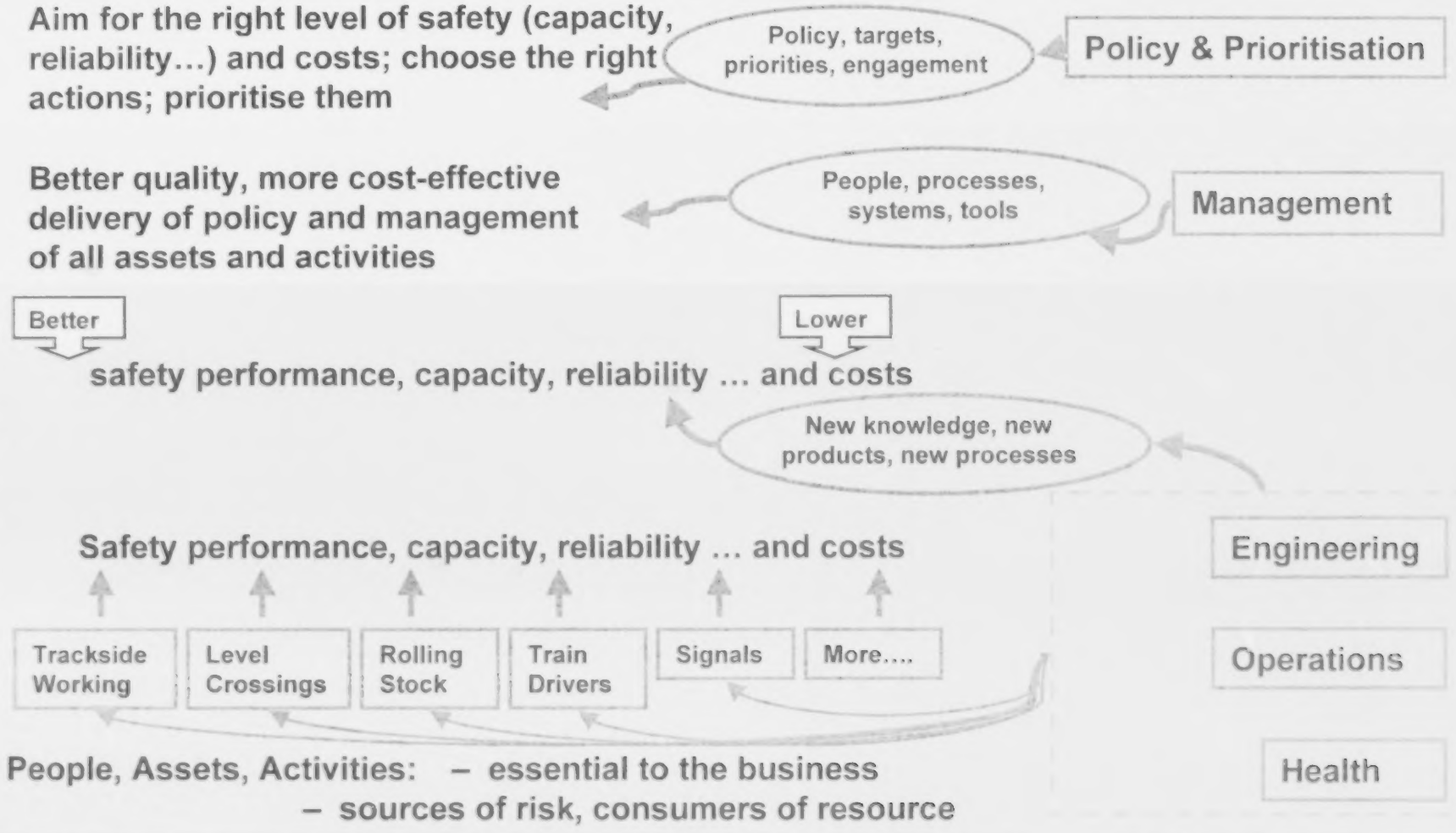
Partnership approach

- Core stakeholders, plus a wider "coalition of the willing"
- A report in someone's bookcase is at best of marginal value, therefore practical tools of value are the core research output
- Protocol in place with FRA, why not with Transport Canada?
- First European research needs workshop in early 2005

The Safety Research Programme

- The principal objectives of the programme are to:
  - Improve the understanding of safety risk
  - Identify and evaluate ways of reducing safety risk
  - Identify and evaluate ways of reducing the cost of safety
  - Identify and evaluate ways of improving the quality and cost-effectiveness of safety management
- Level crossings safety is essentially a road and pedestrian behaviour issue in which the rail sector is expected to lead

The Approach



Key problem areas

- Based on our Safety Risk Model, the main groups at risk are:
  - Pedestrians on user-worked crossings – 32%
  - Motorists and vehicle passengers (on all road crossings) – 19%
  - Rail users on trains colliding with road vehicles on road crossings –15%
  - Pedestrians on protected crossings – 15%
  - Pedestrians on footpath crossings – 11%
- Research needs to target at risk groups and less safe systems in operation

Recent research

- Recent research has included:
  - Development of Improved Risk Tools - A D Little
  - Research into Risk at User Worked Crossings - Human Engineering
  - Study into use of Wayside Horns - A D Little
- Train horn noise has been a major issue in recent times. Risk based response being implemented

Development of risk models

- The existing automatic crossing risk model is being extended by A D Little to cover all types of crossing, and to include operational and other costs
- It will be a valuable tool for Network Rail to prioritise
  - management actions
  - physical improvements
  - upgrading or abolition
- We are nearing the end of development

User-worked crossing risks

- This study by Human Engineering Ltd is examining
  - sighting times and user responses
  - effectiveness of miniature warning lights
  - potential for novel warning devices
- Results are now emerging

Median strips trials

- Based on American experience (and one case in Northern Ireland) RSSB is working with Scott Wilson to develop trials of lane separators at six sites where zig-zagging is a known problem
- This is a complex project with many external stakeholders to be convinced and satisfied

Level crossing data

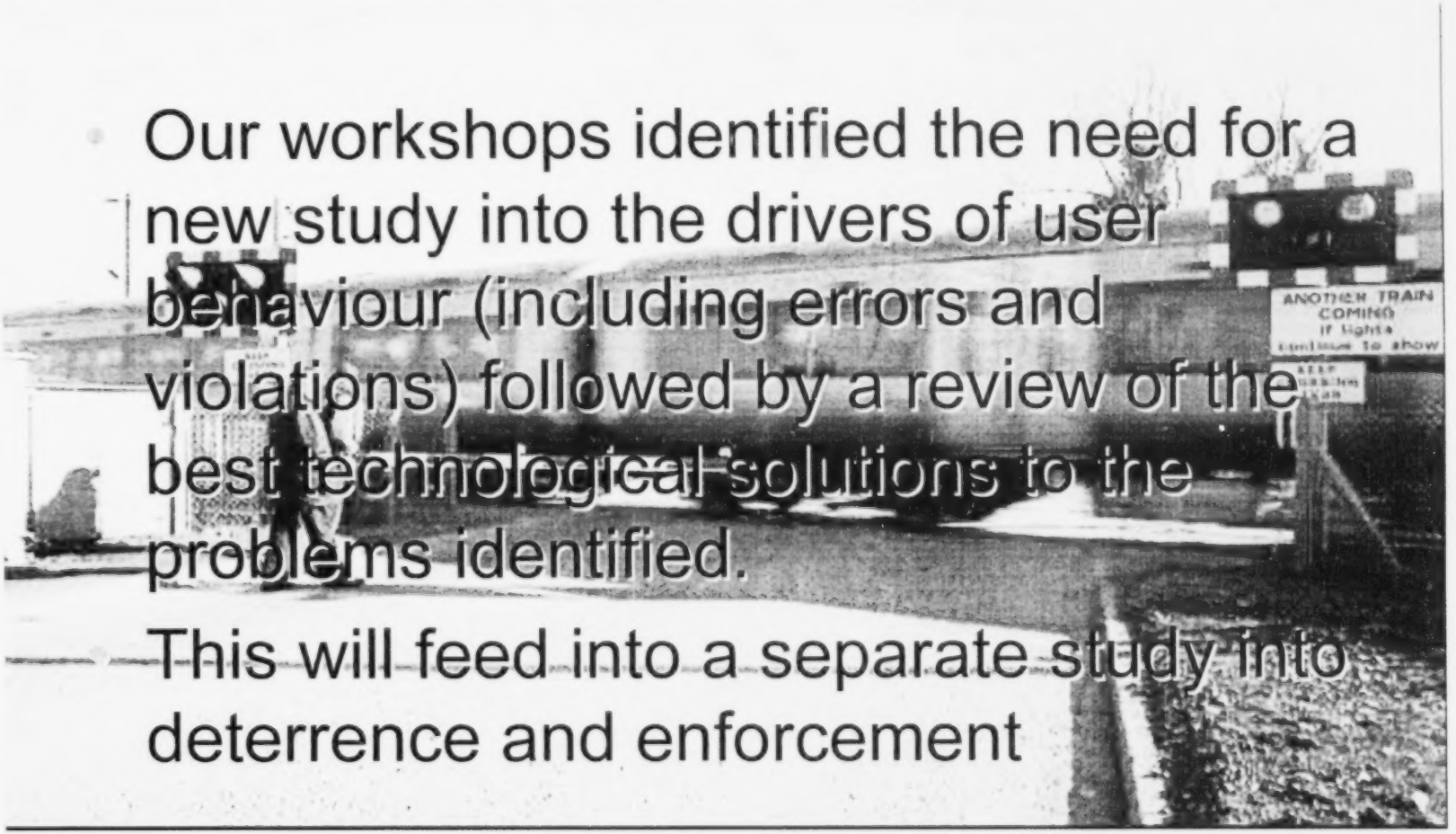
Rail Safety & Standards Board

- There are several databases in existence, within Network Rail and RSSB, and these need to be made comprehensive and compatible with each other
- Halcrow have investigated end user requirements and options for database development

Level crossing upgrade costs

- Addressing why the costs of converting a crossing to one with a lower risk profile have increased in recent years and why UK costs appear more expensive than in comparable countries
- Interim report highlighted concerning relationship between crossing system costs and total project costs
- Report from AD Little is due at the end of November 2004

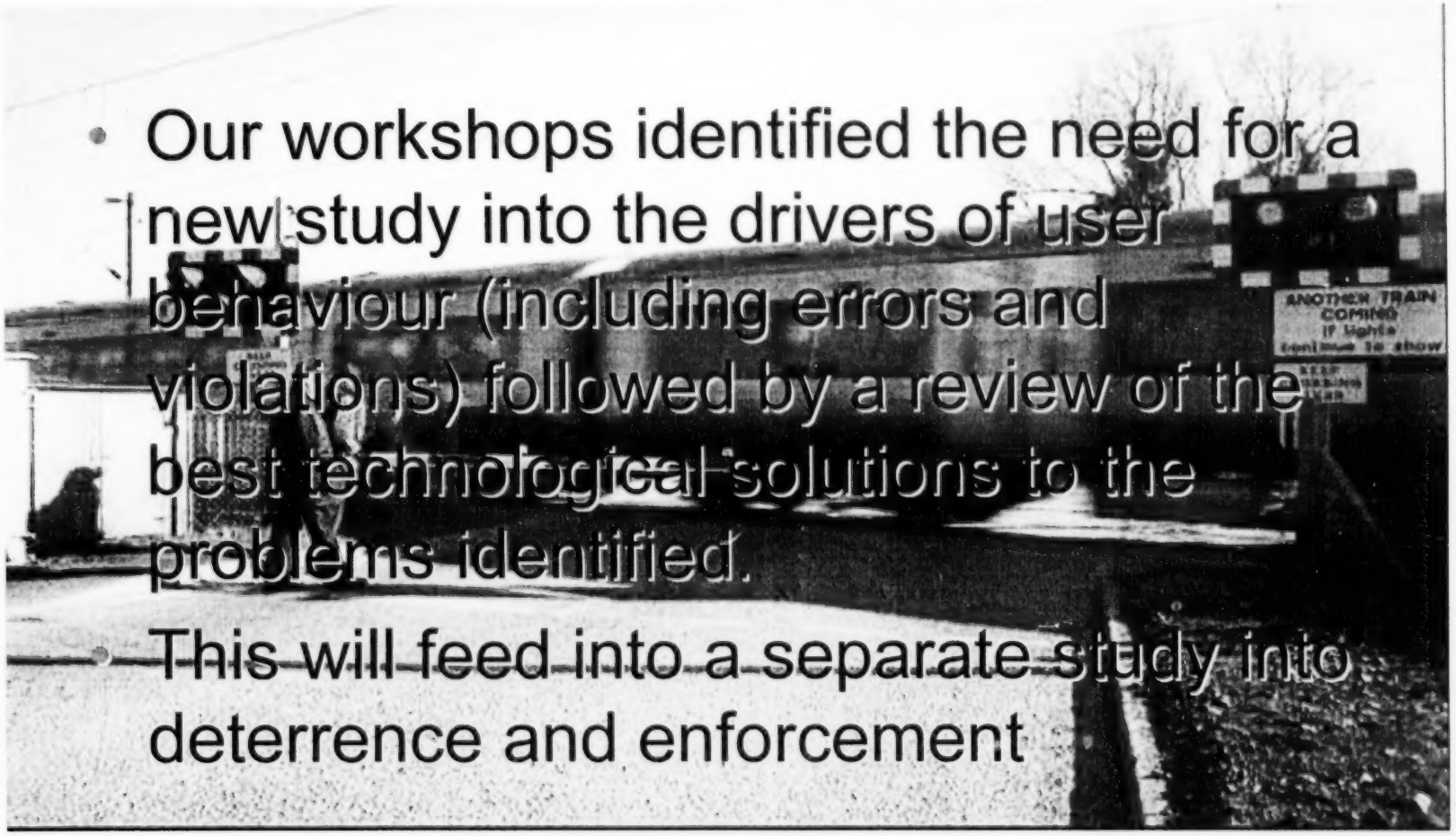
User behaviour and new technology



- Our workshops identified the need for a new study into the drivers of user behaviour (including errors and violations) followed by a review of the best technological solutions to the problems identified.
- This will feed into a separate study into deterrence and enforcement

User behaviour and new technology

Rail Safety & Standards Board



- Our workshops identified the need for a new study into the drivers of user behaviour (including errors and violations) followed by a review of the best technological solutions to the problems identified.
- This will feed into a separate study into deterrence and enforcement

Enforcement mechanisms

- There are a number of approaches to deterrence and penalty regimes to target offenders at level crossings
- These involve photo enforcement within differing legal processes
- This study will seek to evaluate what works best and promote good practice for implementation in England and Wales, and in Scotland

Economics of crossing closure

- Different agencies have often conflicting priorities for and against the closure of level crossings
- Short-term funding pressures can also prevent the optimal solution to a safety and maintenance problem where roads cross the railway
- The study will develop a model for taking the wider, whole life view

Reducing Crossing Movements at User-Worked Crossings

- A gated user-worked crossing requires the motorist to cross the railway five times for every vehicle movement
- There are technical solutions to this increased risk but they have not been widely adopted
- This study will seek to understand why and make recommendations for cost-effective solutions

Crossings at stations

- With the elimination of parcels traffic, many barrow and station crossings have been closed in recent years, in some cases leading to public protests
- Those that still exist have differing risk profiles and there is no comprehensive data on them
- This work will review the situation and make recommendations

Suicide at level crossings

- Recognised as a significant point of entry for prospective pedestrian suicides
- In vehicle suicides considered to be rare, however greater focus on the identification of these is recent
- National Rail Fatalities Management Group in place to build on research from a major academic study

Rail Safety & Standards Board

www.rssb.co.uk

Recent Advances in Highway Crosswalk Signalling and Their Potential Application to Rural Grade Crossings

David Green
Carmanah Technologies Inc., Victoria, B.C., Canada

Abstract

The rapid evolution of light emitting diode (LED) technology has allowed considerable progress in solar-powering of signal lighting for highway applications. In particular, relatively sophisticated and very reliable solar-powered systems have been developed for crosswalk applications. This technology allows pedestrians to activate remote warning lights to show a crosswalk is in use.

The new crosswalk technology offers promise for active signalling at rural grade crossings. The crosswalk technology provides wireless communication to up to 64 signalling assemblies, data logging, and system interrogation to monitor performance and system health. The wireless communication capabilities and the system intelligence can provide reliable train detection.

In the event of an accident, the data logging facility can provide information to show whether the signal lights were working properly at the time of the accident, and potentially detect trespassing.

Recent Advances in Highway Crosswalk Signalling and Their Potential Application to Rural Grade Crossings

David Green, Ph.D.
Research Manager
Carmanah Technologies Inc
Victoria, B.C., Canada

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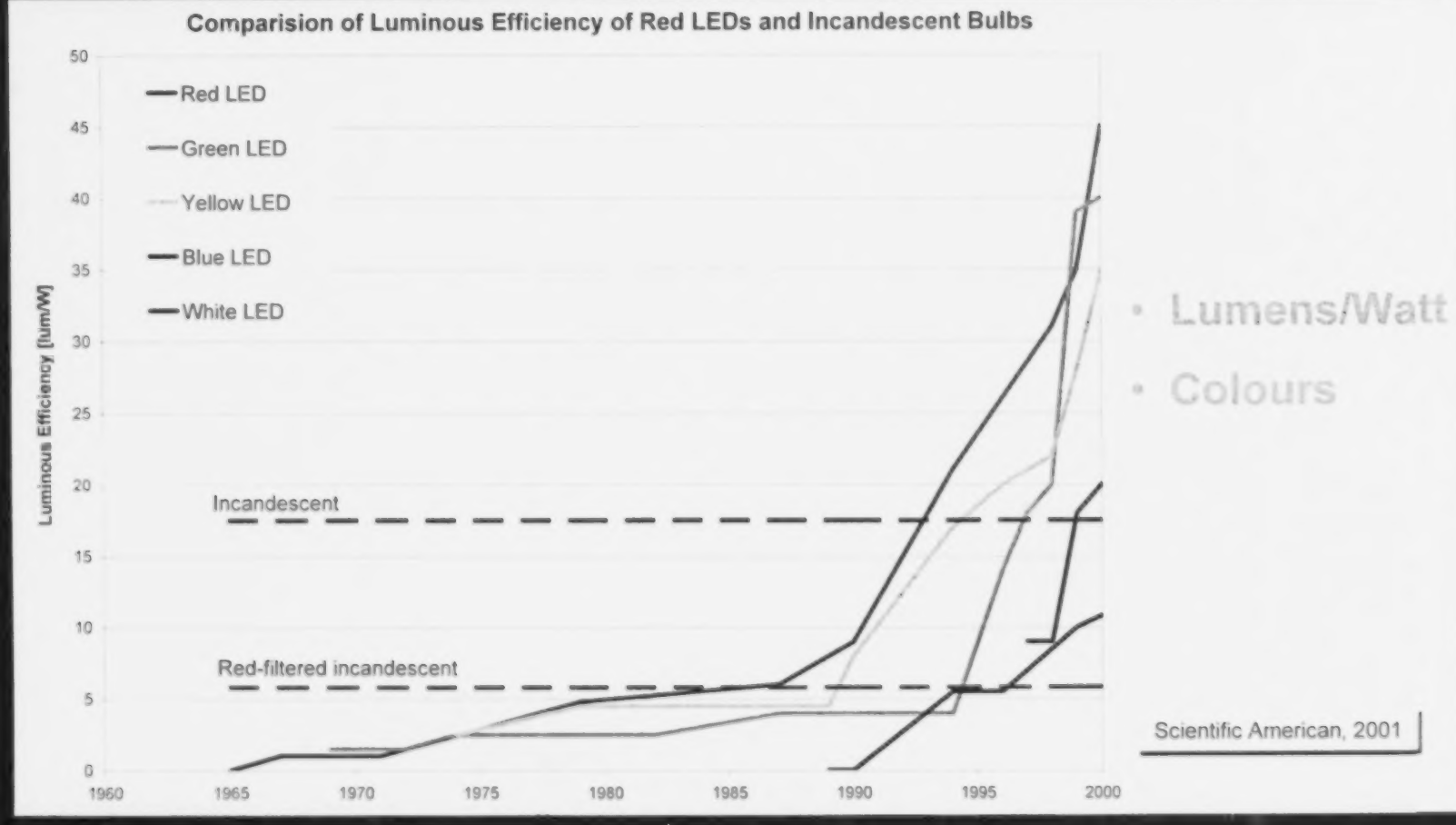
LED Improvement Graph



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Failure Rate and MTBF

Ambient Operating Temperature [°C (°F)]	LED Chip Temperature [°C (°F)]	Mean Time Between Failure (MTBF) [hours]	Device Failure Rate λ [%/1000 Hours]
85 (185)	103 (217)	848,000	0.188 %
75 (167)	93 (199)	1,220,000	0.082 %
65 (149)	83 (181)	1,791,000	0.056 %
55 (131)	73 (163)	2,688,000	0.037 %
45 (113)	63 (145)	4,133,000	0.024 %
35 (95)	53 (127)	6,525,000	0.015 %
25 (77)	43 (109)	10,701,000	0.009 %
15 (59)	33 (91)	17,978,000	0.006 %
5 (41)	23 (73)	30,922,000	0.003 %

MTBF and Failure Rate for Precision Optical Performance AlInGaP LED T-1 3/4 Plastic Lamps (Agilent Application Brief I-004)

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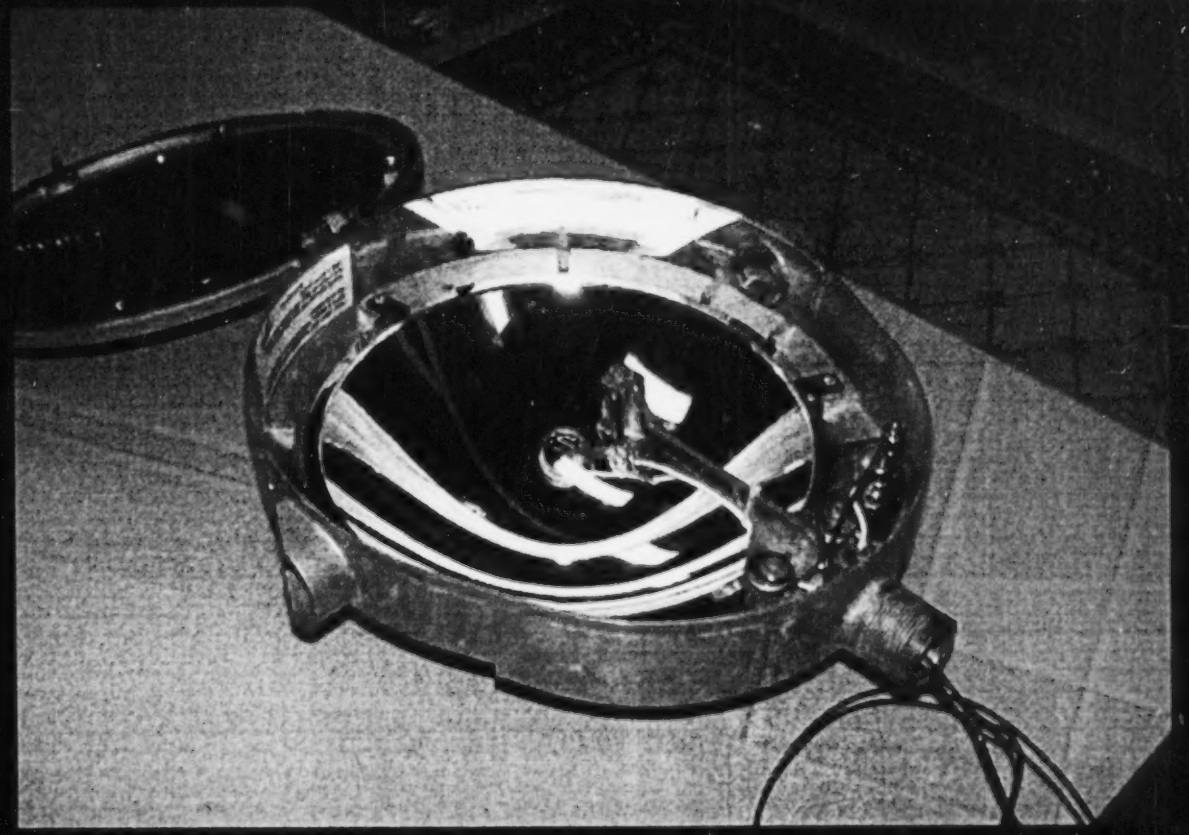
Incandescent Crossing Light



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LED Test Lights in Housings

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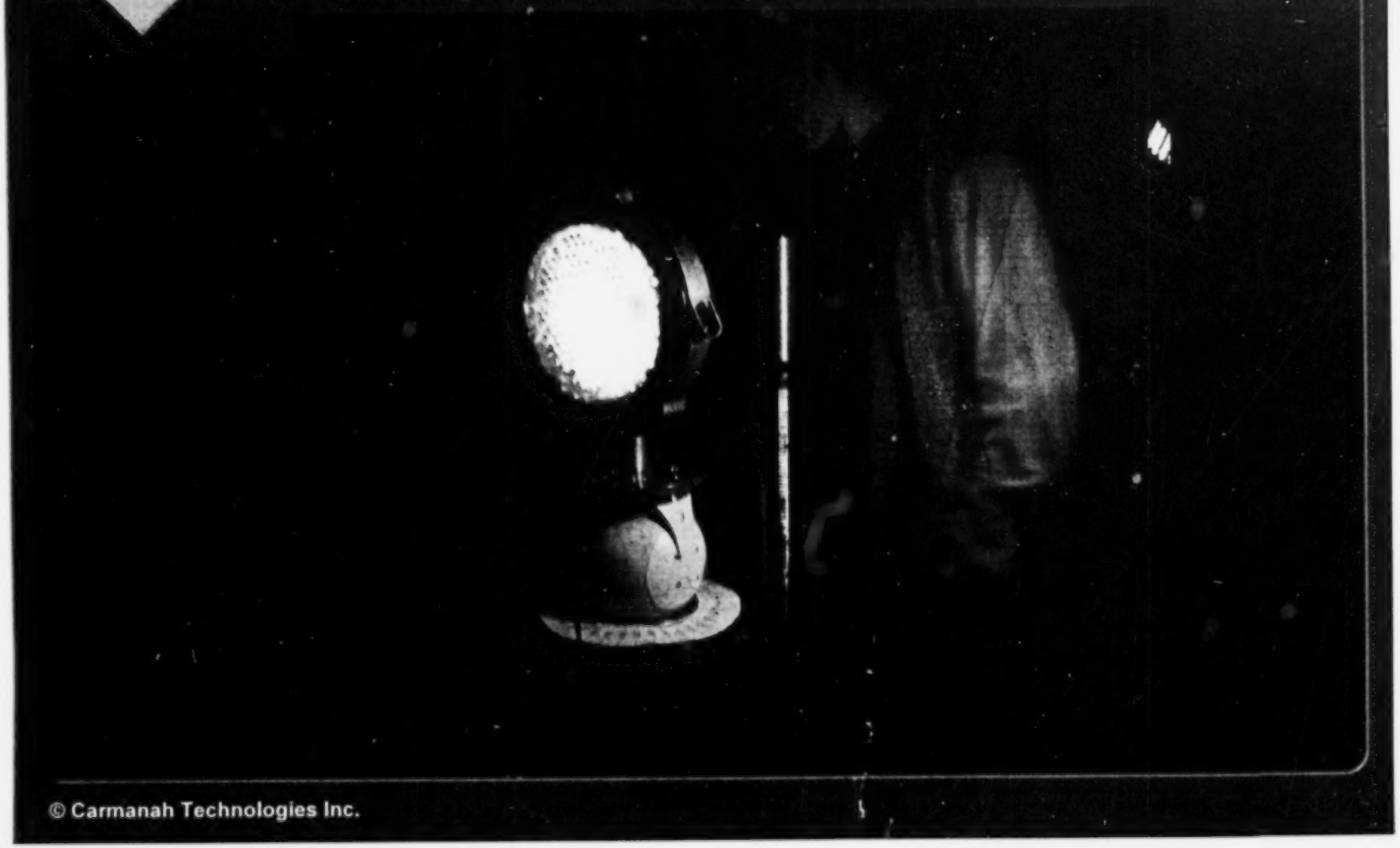
Photometric Lab Results



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Field Test Results

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Lights from 100 yards

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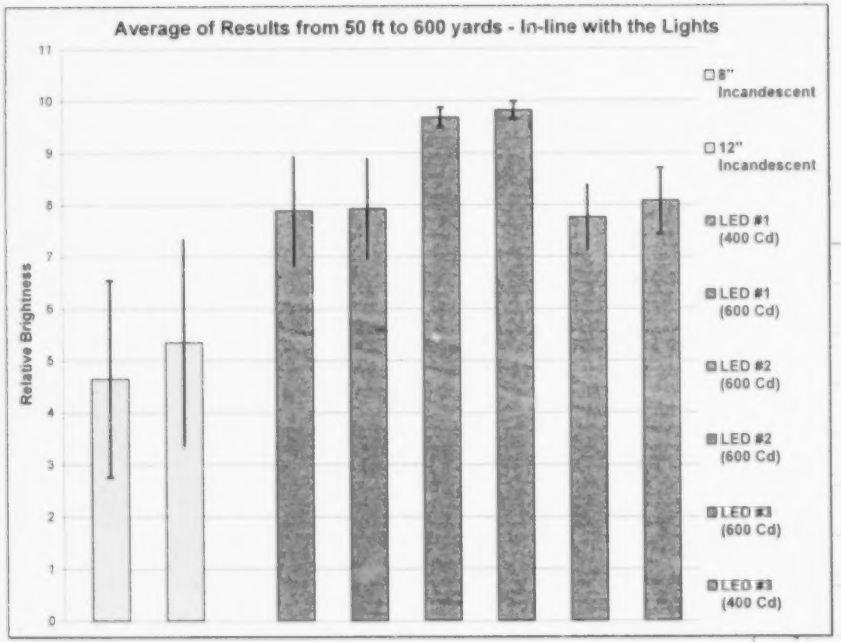
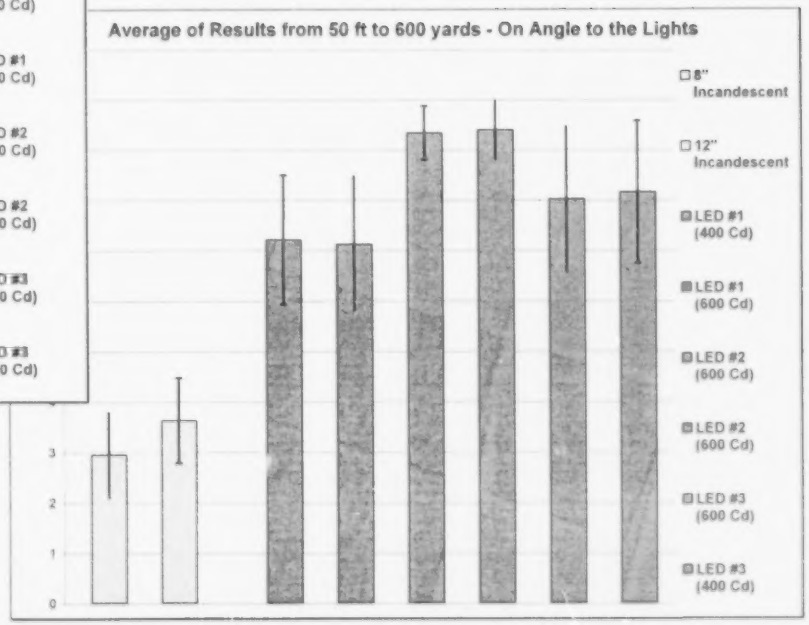
Field Test #3: *Daytime* *(Part 2)*



In-line with the lights



On angle to the lights

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Field Test Results (cont.)

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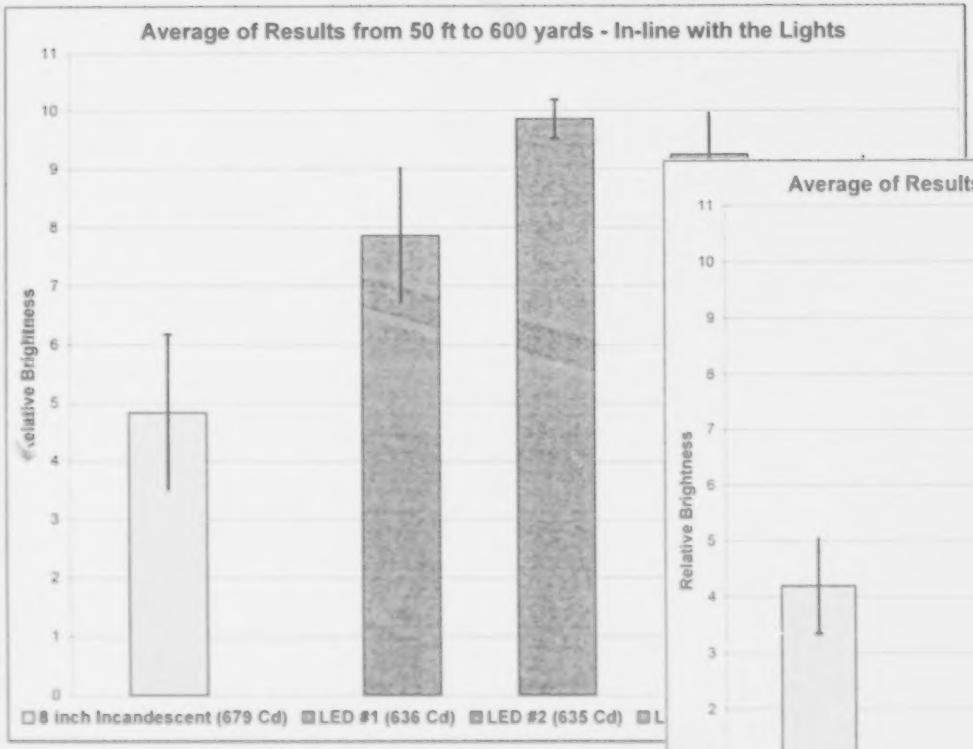
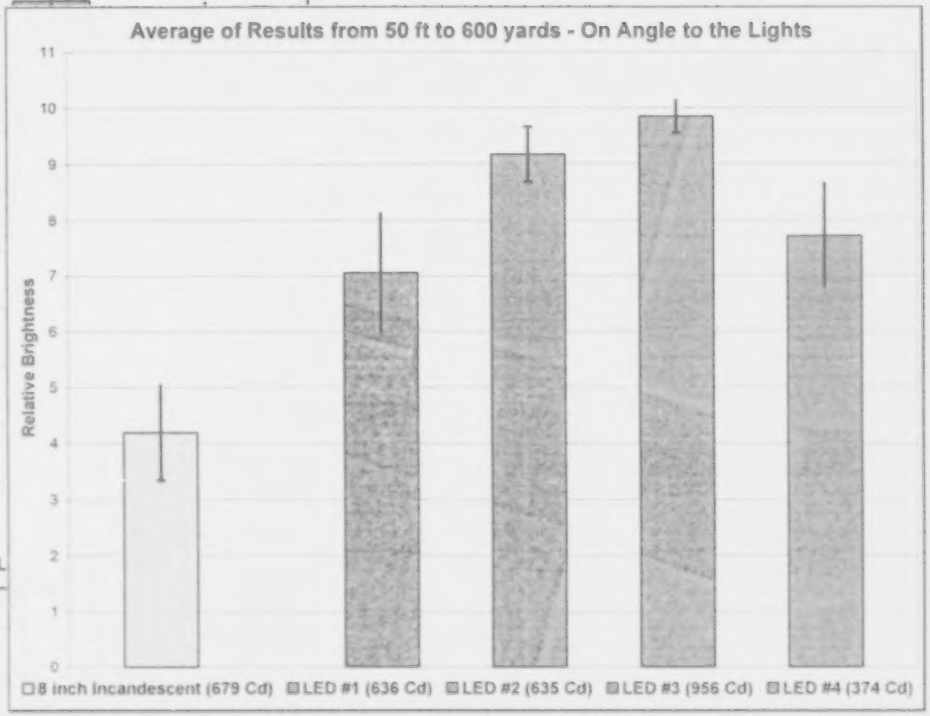
Field Test #1: *Nighttime*





On angle to the lights

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Benefits of LED Technology

- Broader beam pattern so more visible to driver
- Beam pattern is universal, so standardized lights
- No need for regular alignment
- Don't need overhead catwalks, just traffic light structures.
- Much less maintenance

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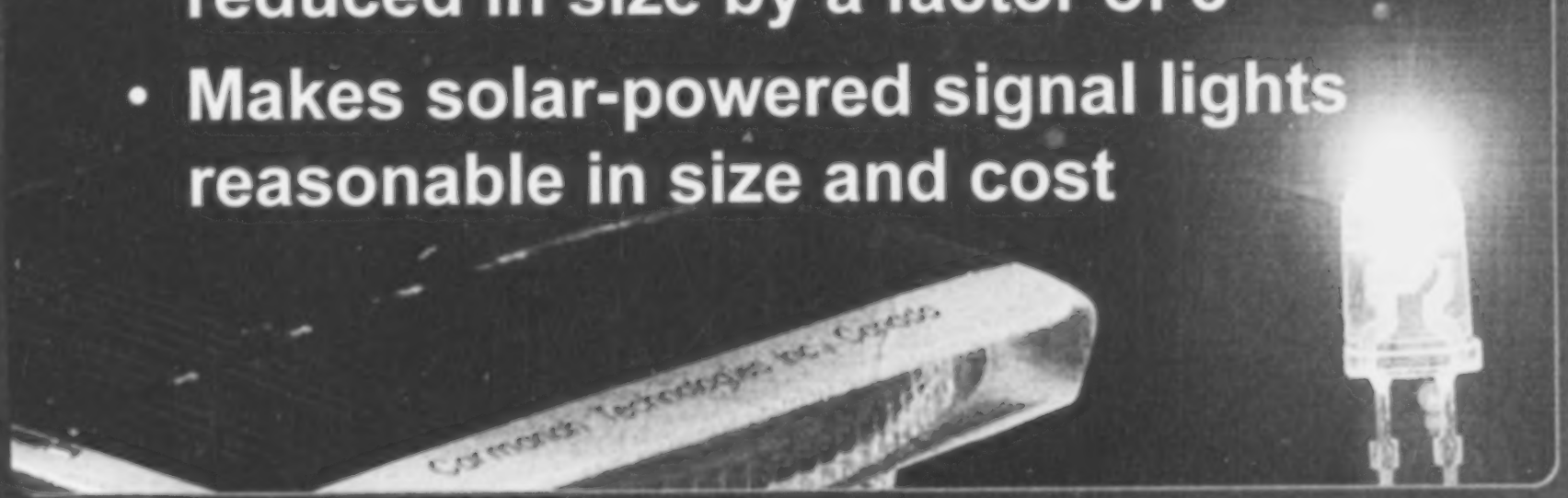
LED Technology Also Enables Solar Solutions

- 5 times improvement in efficiency of LED lights over conventional lighting means solar power systems can be reduced in size by a factor of 5
- Makes solar-powered signal lights reasonable in size and cost



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"Passive" Warning Lights

- Solar powered LED warning lights now are used to indicate crosswalks (and other hazards)
- Flash continuously to improve conspicuity of signage
- Low cost, meet specifications, easy to install
- More reliable than grid powered lights?

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"Active" Crosswalk Beacons

- Solar-powered crosswalk assemblies comprising:
  - LED lights
  - wireless communication
  - intelligence
  - one crosswalk assembly on each side of the road
  - wireless communicate

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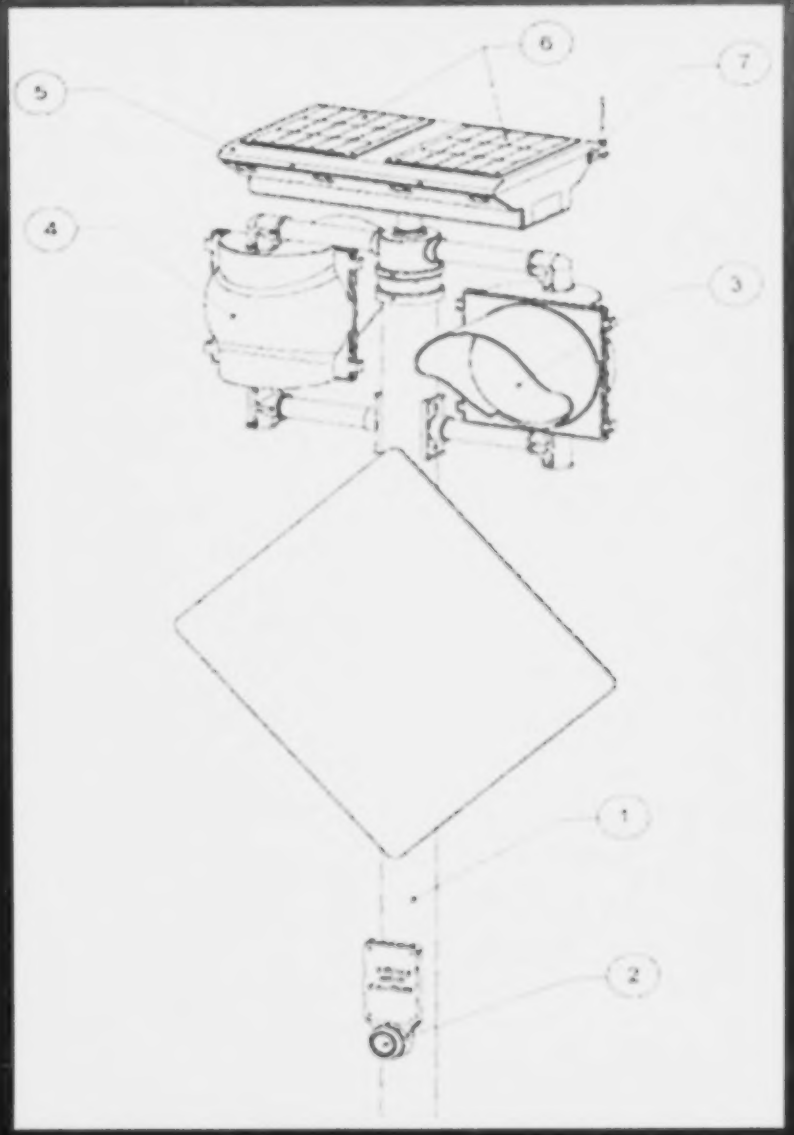
Illustration:

Crosswalk Assembly



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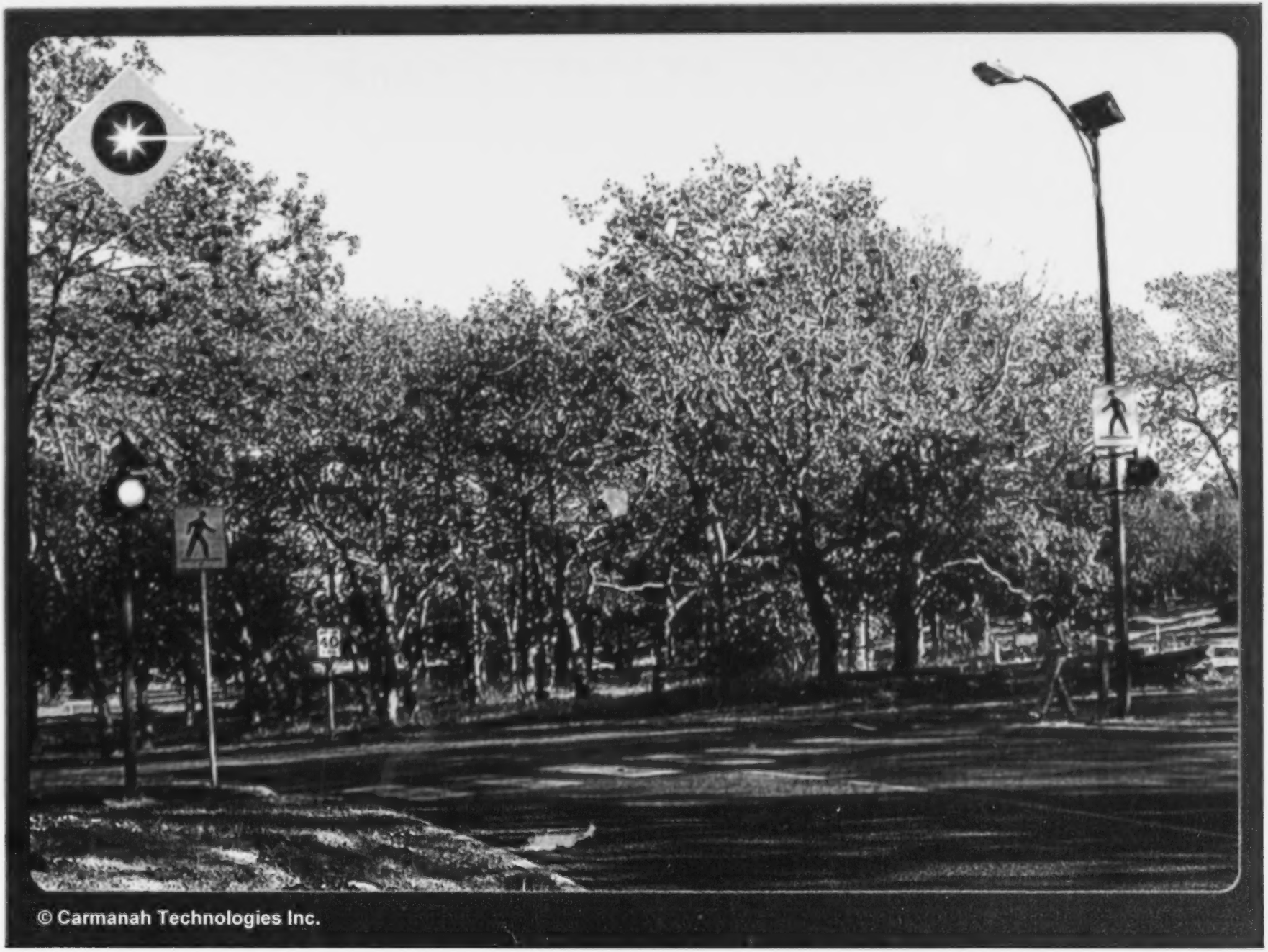
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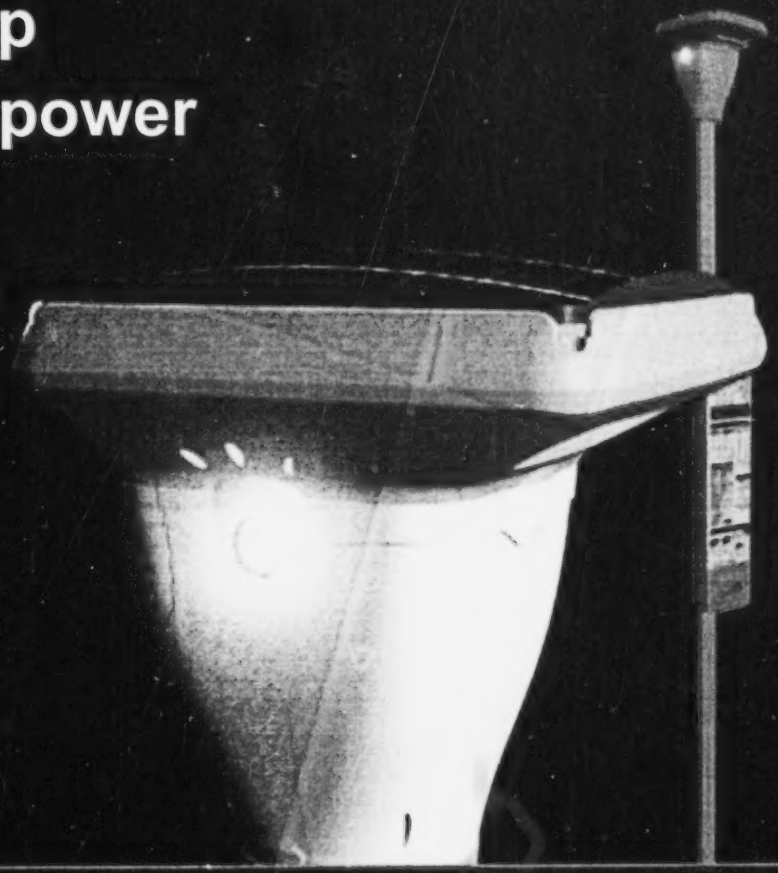
iSTOP™

- i-STOPS™ are bus stop assemblies with solar power plants that provide:
  - A bus signal device
  - Safety area lighting
  - Bus schedule illumination



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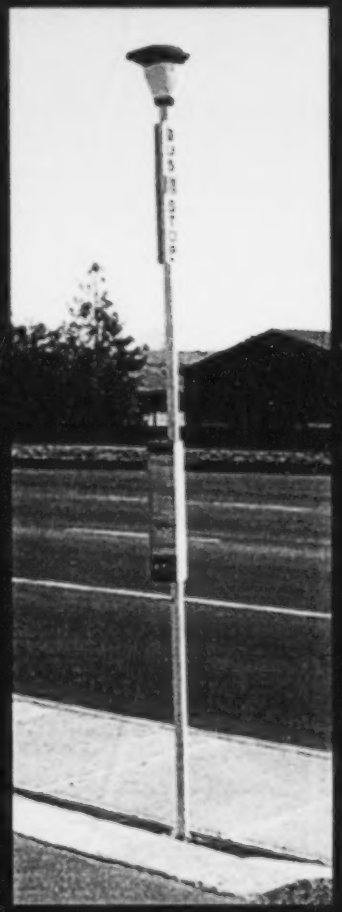
Solar i-STOP™ Systems Used for Train Detection

- i-STOPs can be fitted with motion sensors to detect the train
- signal light shows the train that the grade crossing lights are activated
- 3 i-STOPs used on each approach for redundancy



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Application of Solar Crosswalk Assemblies and i-STOPs to Rural Grade Crossing

- Solar LED crosswalk assemblies used on both approaches to the crossing
- Train activation by motion sensors in i-STOP units
- Wireless system used to communicate between motion sensors and crosswalk assemblies
- Intelligence used for confirming train approach and timing light activation and de-activation
- Data-logging to record usage/system health – downloads wirelessly to lap-top

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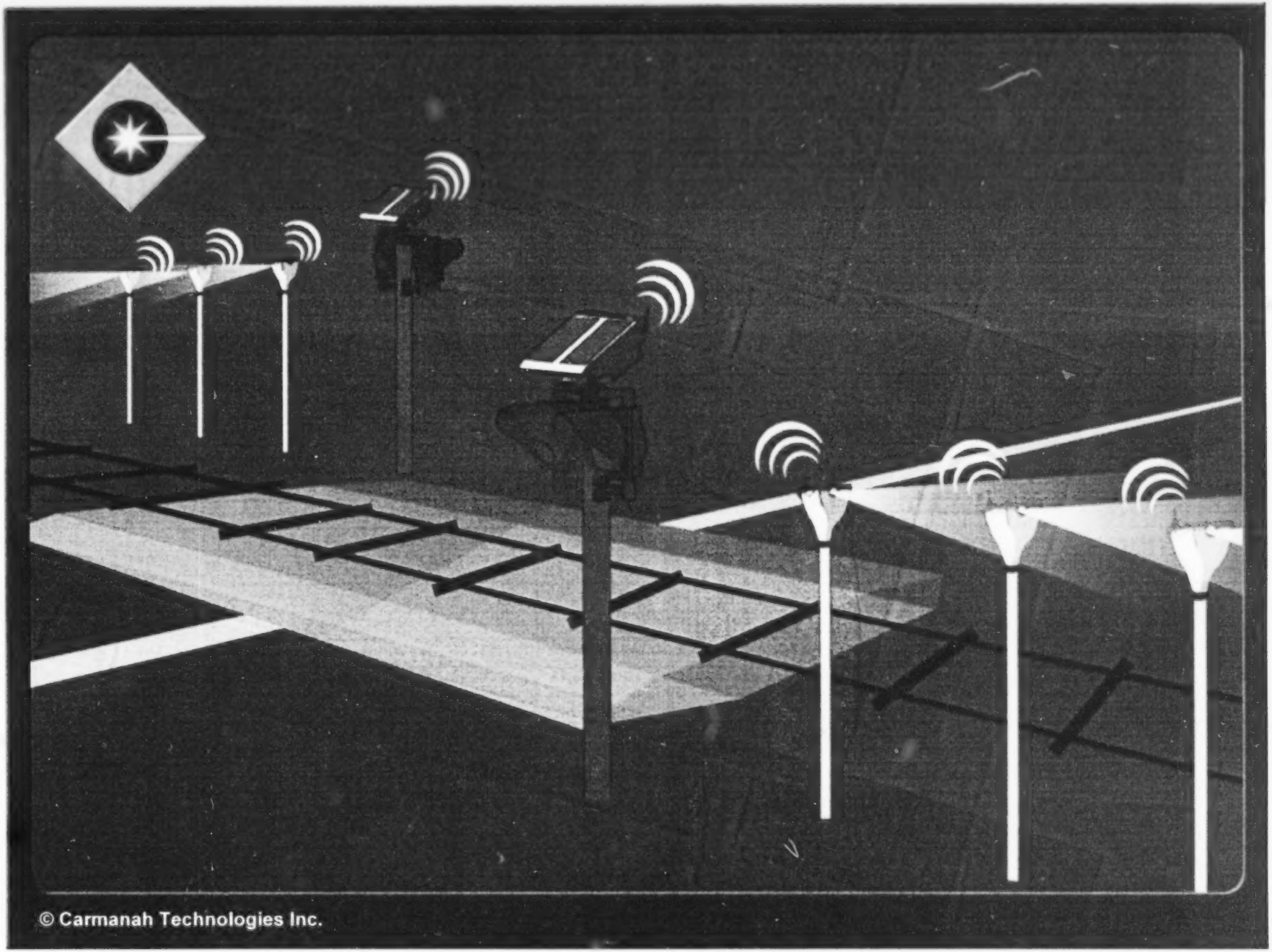
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System Advantages

- Independent of the electricity grid
- Each assembly is self-sufficient
- Redundant train detection
- No trenching for wires & cables
- No track work required
- LED lights meet Transport Canada specifications
- Building blocks are commercially available and in use on highways
- Data logging provides proof of operation
- Cost effective

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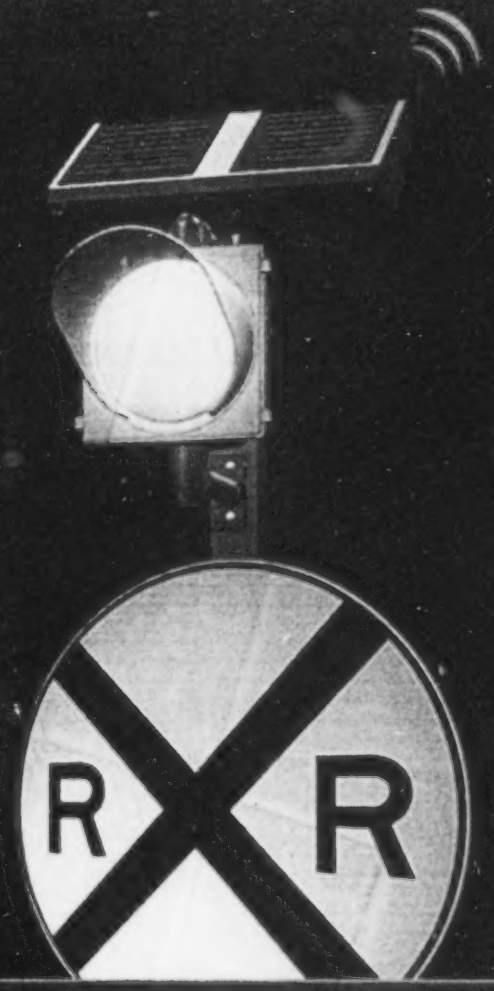
Possible Path Forward

A research program to test passive and active solar-powered LED systems?



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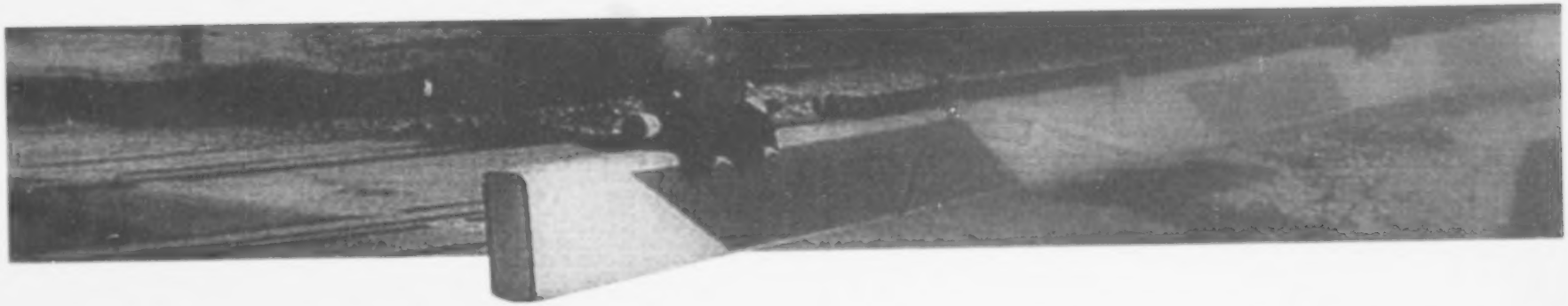
Evaluating Safety Counter-measures at Highway-Railway Grade Crossings

Frank Saccomanno and Peter Young-Jin Park
Department of Civil Engineering, University of Waterloo, Waterloo, Ontario, Canada

Abstract

Various countermeasures can be introduced to reduce collisions at highway-railway grade crossings. Existing improvements to crossings may include the installation of flashing lights or gates; the addition of extra warning devices such as four quadrant barriers, wayside horn, etc., and/or the enforcement of speed limits on the approaching highway. Statistical models are needed to ensure that cost-effective and practicable countermeasures are introduced at a given crossing. Due in large part to issues of co-linearity, poor statistical significance and parametric bias, existing collision prediction models tend to be simple in structure with few statistically significant explanatory variables. As such, these models fail to reflect the full spectrum of variability in observed collision frequency at individual crossings. In order to use statistical models to investigate the cost-effectiveness of specific countermeasures, we need to develop models that more fully



reflect the complex relationship linking countermeasure to collision occurrence.

In this presentation, we introduce a model structure for predicting collisions at grade crossings that is based on a combination of data partitioning and statistical methods. By using these models we can estimate the individual and combined effect of changes in countermeasures on crossing collisions. This study makes use of Canadian inventory and collision data to illustrate the potential merits of the model in decision-support.

Evaluating Safety Counter-measures at Highway-Railway Grade Crossings

Frank Saccomanno and Peter Young-Jin Park

Department of Civil Engineering
University of Waterloo

Sixth Annual Workshop on Highway-Railway Grade Crossing Research

Nov 22, 2004
Montreal, Canada

Outline

1. Background
2. Objectives
3. Current Approaches
4. Study Framework
5. Data for Preliminary Analyses
6. Preliminary Results
7. Future Work

Background

- Each year in Canada, a significant no. of casualties occur as a result of grade crossing collisions.

- Need a reliable model for targeting unsafe crossings. Need a reliable model for developing and evaluating cost-effective treatments for collision reduction.

Focus: Model to assist in developing and evaluating counter-measures or treatments.

Objectives

1. Explore different model structures for evaluating counter-measures or treatments applied at different types of crossings. *Two model structures will be considered:*

   A stratified model:
   1) Group crossings on basis of inventory attributes (control factors).
   2) Develop separate prediction models for each group for counter-measures.

   An unstratified model that considers interactions among control and counter-measure factors in a single prediction expression.

2. Apply models to Canadian inventory and occurrence data and compare results for selected treatments.

Current Approaches

- Before-and-after analysis
- Cross-sectional analysis (i.e., statistical models)
- Stratified analysis (Use of Factor/cluster analysis)

Before-and-After Analysis

- Most widely used method. Compare with and without treatment at crossings with similar attributes.
- Unresolved problems:
  - ✓ Difficult to provide for full control on crossing attributes.
  - ✓ Regression-to-the-mean biases. Coll high – Treat- Coll Low Overestimates treatment effect.
  - ✓ Uncertainty concerning number of treatment sites within each control sample.

Cross-Sectional Analysis

- Statistical models based on cross-sectional data used to predict collisions. Approach used to identity Blackspots.

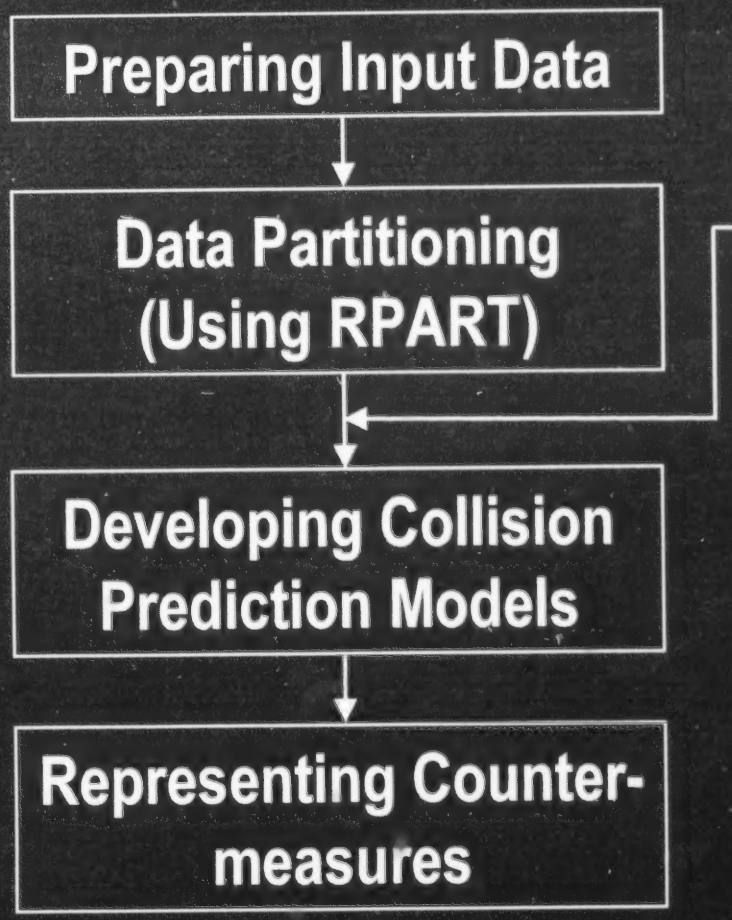
  e.g US DOT and TDC models.

- Cross-sectional models have a number of problems:
  - ✓ Lack of statistical significance (missing treatments).
  - ✓ Counter-intuitive model parameters (colinearity).
  - ✓ Lack of interactions.

Factor/Cluster Analysis

- Control and counter-measure inputs translated into underlying factor scores and used as seed points in Cluster Analysis.
- Collision prediction models developed separately for each cluster *(Saccomanno and Lai, 2004).*
- Attempts to resolve the problem of co-linearity, lack of statistical significance and associated biases.
- Unresolved problems:
  - ✓ Assumes inputs follow a normal distribution. Acceptable for scalar inputs, but inappropriate for categorical inputs. Current research to resolve this problem.
  - ✓ Engineering judgment in factor/cluster exercise.

Study Framework

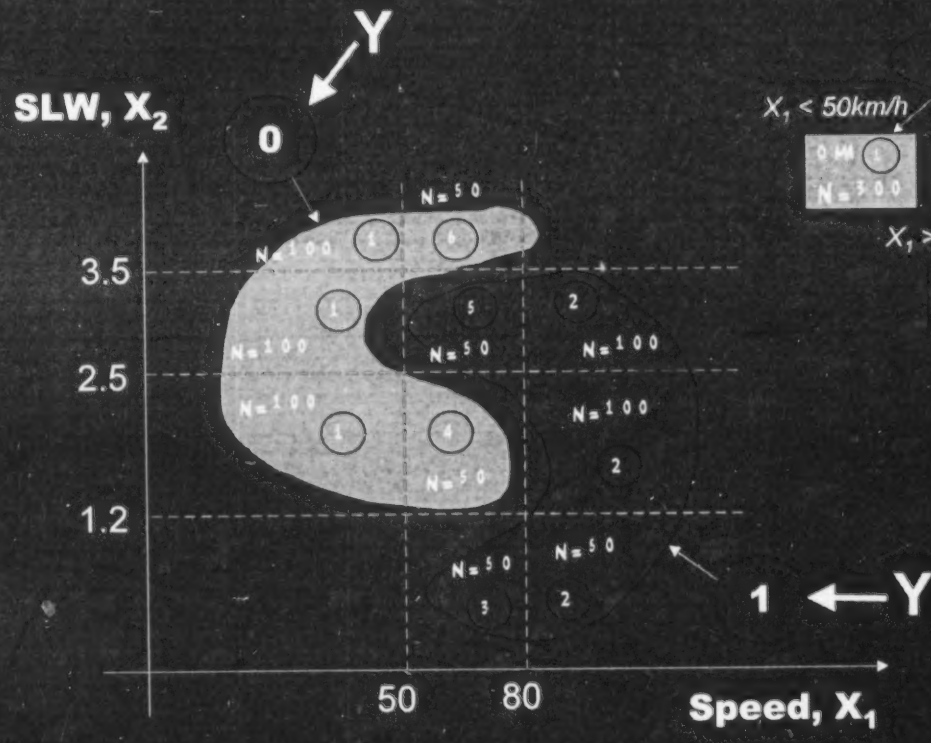


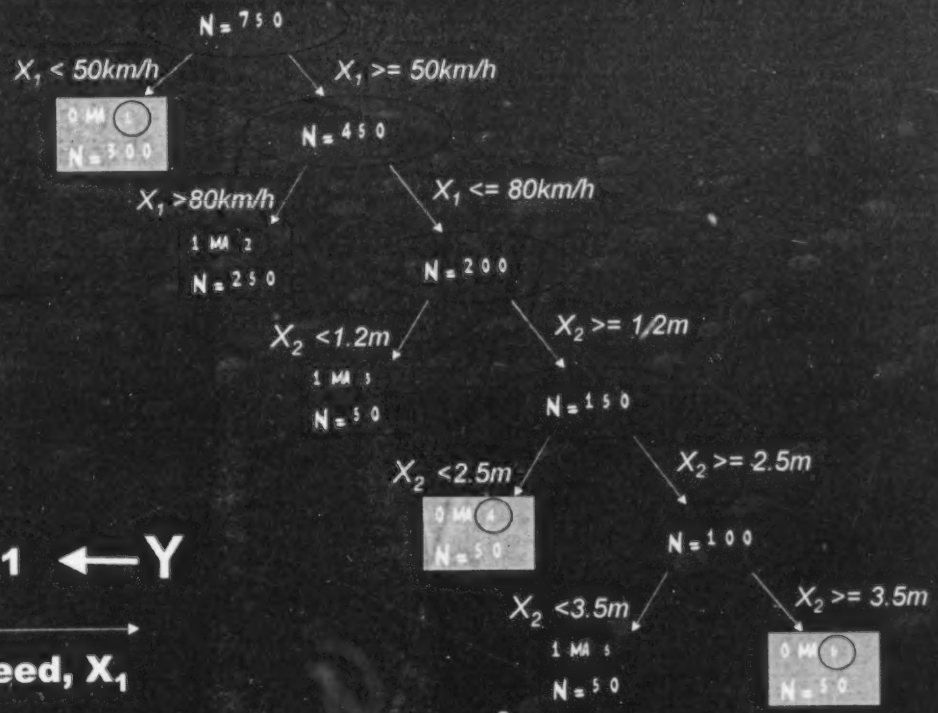
Model 1: Stratified. Classify data into groups using control factors. Develop group-specific models.

Model 2: Unstratified. Use classifiers to reflect interactions in a single prediction expression.

- ✓ Control factors: jurisdiction, weather, etc.
- ✓ Counter-measures: engineering factors such as warning devices, pavement condition, etc.

Illustration of RPART Classification





$$\text{Info Gain} = D_C - (D_L + D_R)$$

D_C = Variance for Input Group (upper level)

D_L = Variance for Left Sub-Group

D_R = Variance for Right Sub-Group

Data for Preliminary Analyses

- Crossing Inventory Data (Transport Canada)
  - ✓ Total 29,507 highway-railway grade crossings in Canada.
  - ✓ 6,014 crossings used in initial analysis.
  - ✓ 13 variables considered.
- Collision Occurrence Data (National TSB)
  - ✓ Total 2,905 collisions reported over 9-year period 1993-2001.

Preliminary Results

- Develop a stratified model (separate Poisson expressions for each group).
  → Model 1

- Develop unstratified model for all groups and interactions (one Negative Binomial expression).
  → Model 2

Preliminary Parameter Estimates (Model 1)

- Four Groups and Combined Poisson expressions.

Models Variables	Stratified Models based on Individual Class				1e Stratified Model with Class Indicator Dummy Variables
	1a Model For Class 1	1b Model For Class 2	1c Model For Class 3	1d Model For Class 4	
	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Warning Device					
Flashing Lights	-1.534	-1.165	-1.552	-1.348	-1.487
Gates	-2.755	-2.207	-2.395	-1.079	-2.716
*Active Warning Devices**	*N/A*	*N/A*	*N/A*	*-1.286*	*N/A*
Extra Warning Devices	-	-	-	-	-
Surface Type	-	-0.669	-0.960	-	-0.386
Track Angle	-	-0.424	-0.517	-	-0.276
Surface Width	-0.025	-0.120	-0.074	-0.190	-0.042
Whistle Prohibition	-0.488	-	-	-	-0.390
Posted Road Speed	0.008	-	-	-	0.004
Time-Table Train Speed	0.002	0.007	-	-	0.003
Class Indicator 01 (CI01)	N/A	N/A	N/A	N/A	-4.230
Class Indicator 02 (CI02)	N/A	N/A	N/A	N/A	-4.070
Class Indicator 03 (CI03)	N/A	N/A	N/A	N/A	-3.829
Class Indicator 04 (CI04)	N/A	N/A	N/A	N/A	-3.216
log(Exposure)	1.0	1.0	1.0	1.0	1.0
Constant	-4.995	-3.500	-2.785	-1.618	*N/A*

Preliminary Parameter Estimates (Model 2)

- Seven Modifiers in the Negative Binomial expression.

Explanatory Variable	Coefficient
Warning Devices	
Flashing Lights (FL)	-0.326
Gates (GT)	-1.406
Surface Type (ST)	-0.302
Train Speed	
Medium Level Speed (TMS)	0.641
High Level Speed (THS)	0.746
Modifier 01 (M01)	-1.050
Modifier 06 (M06)	0.652
Modifier 07 (M07)	1.004
Modifier 11 (M11)	0.681
Modifier 13 (M13)	-0.411
Modifier 16 (M16)	1.086
Constant	-4.813
log (Exposure)	1.000

For Example,

- ✓ M01 influences on those crossings with flashing lights or gate, and in the arterial/collector or local road, and not influences on other crossings (2nd order interactions).
- ✓ M11 influences on those crossings with signs, with medium-level train speed, with non-perpendicular track angle, and not influences on other crossings (3rd order interactions).

Expected Collision Reduction

Collision Prediction Models	Meaning of Groups	Improvement: Signs to Flashing Lights
Model 1: Stratified Models with using Poisson Expression (4 Groups)	Arterial/Collector (Class 1)	78 %
	Local/Other Road Type & Multiple Track (Class 2)	69 %
	Local Road & Single Track (Class 3)	79 %
	Other Road Type & Single Track (Class 4)	74 %
	Entire Crossing Data with Class Indicator Dummy Variables	77 %
Model 2: Un-stratified Models with Modifiers using NB Expression (7 Groups)	Main Effect	28 %
	Arterial/Collector/Local Road (C01)	75 %
	Local Road & Unpaved & Single Track & Surface Width over 13.5 m (C16)	25 %
	Train Speed over 90 km/h (C06)	62 %
	Train Speed between 35 km/h and 90 km/h (C07)	74 %
	Train Speed between 35 km/h ~ 90 km/h & Non-Perpendicular Track Angle (C11)	87 %
	Train Speed between 35 km/h ~ 90 km/h & Non-Perpendicular Track Angle & Posted Road Speed under 85km/h (C13)	80 %
TDC 2003 Model by Saccomanno and Fu	Average	60 %
US DOT 1985 Model by Farr	Average	70 %
FRA 2002 Model by GradeDec 2000 v.2	10 or less Daily Train & Single Track	75 %
	10 or less Daily Train & Multiple Track	65 %
	More than 10 Daily Train & Single Track	61 %
	More than 10 Daily Train & Multiple Track	57 %

Preliminary Findings

- Tree-based stratification can be effectively used to eliminate potential biases from control factors (Model 1).

  Provide a better estimate of changes in expected collisions subject to treatments. A strong basis for decision-support.

- Interaction effects were considered as modifiers (Model 2).

  Accounts for complex mix of both control and counter-measures inputs.

Barlow Trail Rail Crossing Congestion Mitigation

Doug Morgan
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Abstract

Barlow Trail is a key roadway in the City of Calgary's transportation network. The roadway provides access to a large industrial area in southeast Calgary. Barlow Trail carries 36,000 vehicles daily, with morning peak hour volumes reaching 2,600 vehicles. Traffic volumes are approaching the capacity Barlow Trail can provide. South of the intersection at 50th Avenue and Barlow Trail there is an at-grade railway crossing. This crossing includes three tracks that service both the main line and Canadian National Railway's (CN) intermodal terminal. The crossing connects the intermodal terminal to the rest of the industrial area and CN's customers. In addition, shunting activities at the terminal frequently use the Barlow Trail Crossing. This causes unpredictable blockages of Barlow Trail.

Significant roadway traffic delays occur when rail operations block Barlow Trail. Since the intersection north of the crossing is nearing capacity, queues from a blockage can

linger long after the train has cleared the crossing. The City of Calgary has received many complaints about delays at this location. If the crossing is blocked for a long period of time queues can extend all the way onto the Deerfoot Trail (an adjacent freeway) and adversely affect freeway operations.

In order to address these issues, an Intelligent Transportation System (ITS) solution was proposed. There were challenges in analysing the problem using conventional tools. Several microsimulation tools were employed to predict the effectiveness of the solution. Results of the analysis justified the pursuit of an ITS solution. Three components were combined — queue detection, enhanced operation, and traveller information. The integration of these three components into a fully automated system will allow the City to maximize the capacity of Barlow Trail.

Barlow Trail Rail Crossing Congestion Mitigation

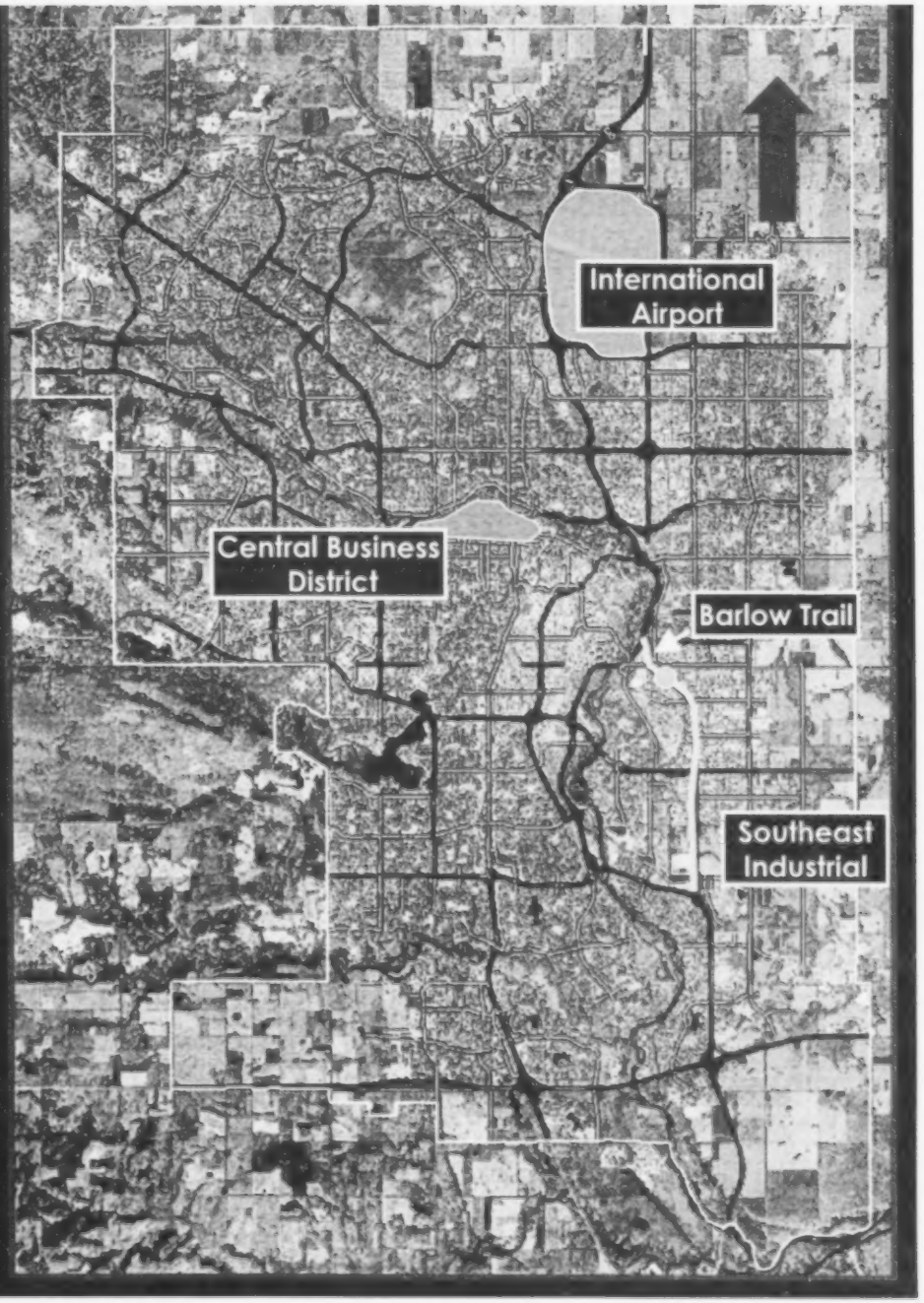
Sixth Annual Workshop on
Highway-Railway Grade Crossing
Research

Outline

- Background
- Problem
- Solution Development
- Selected Solution
- Questions

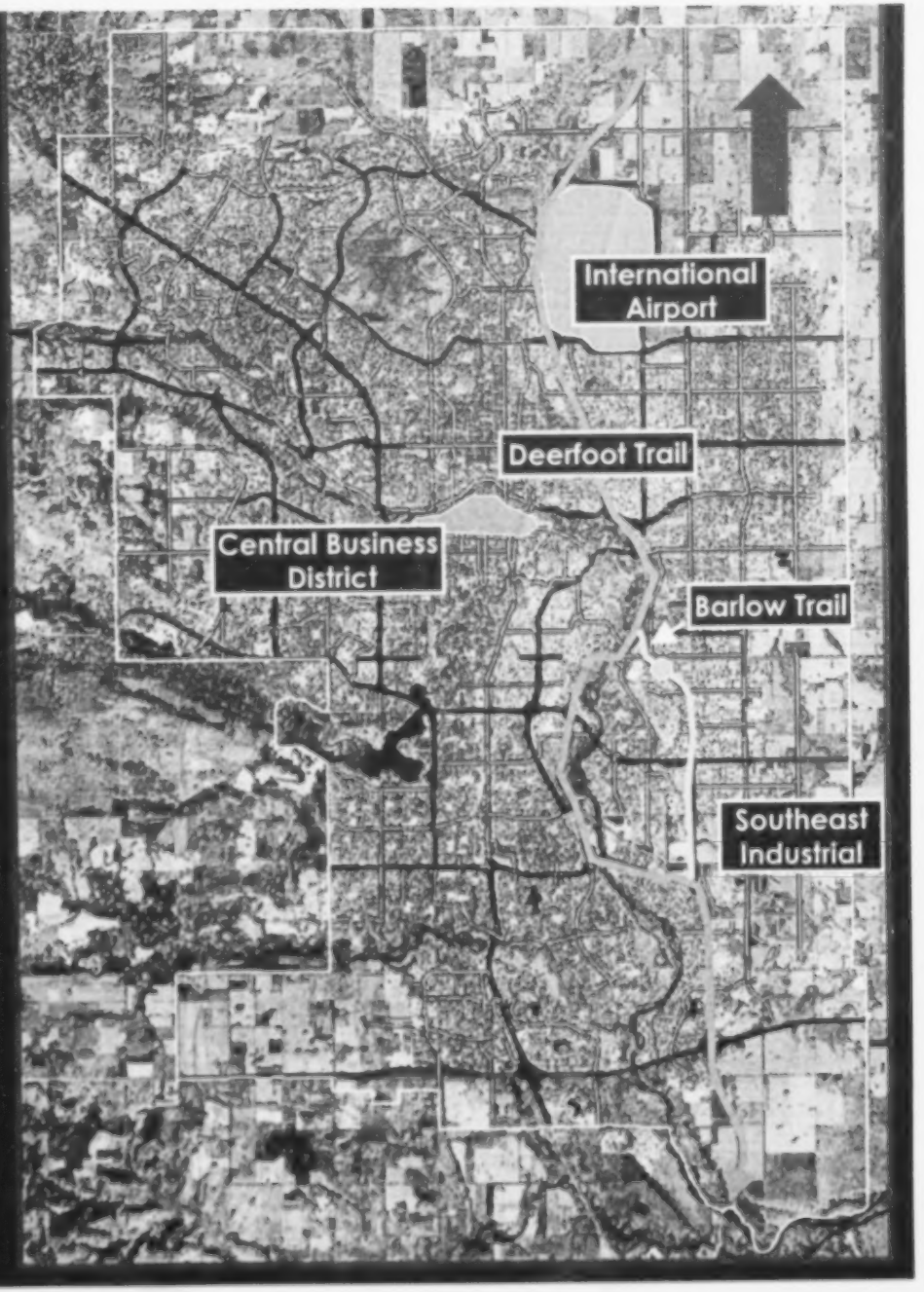
Background

- Calgary Population =922,315
- Barlow Trail
- **Rail Crossing Location**



Background

- Deerfoot Trail Freeway
  - 100000-160,000 vpd
  - Major N-S corridor
  - Canamex Corridor



Background

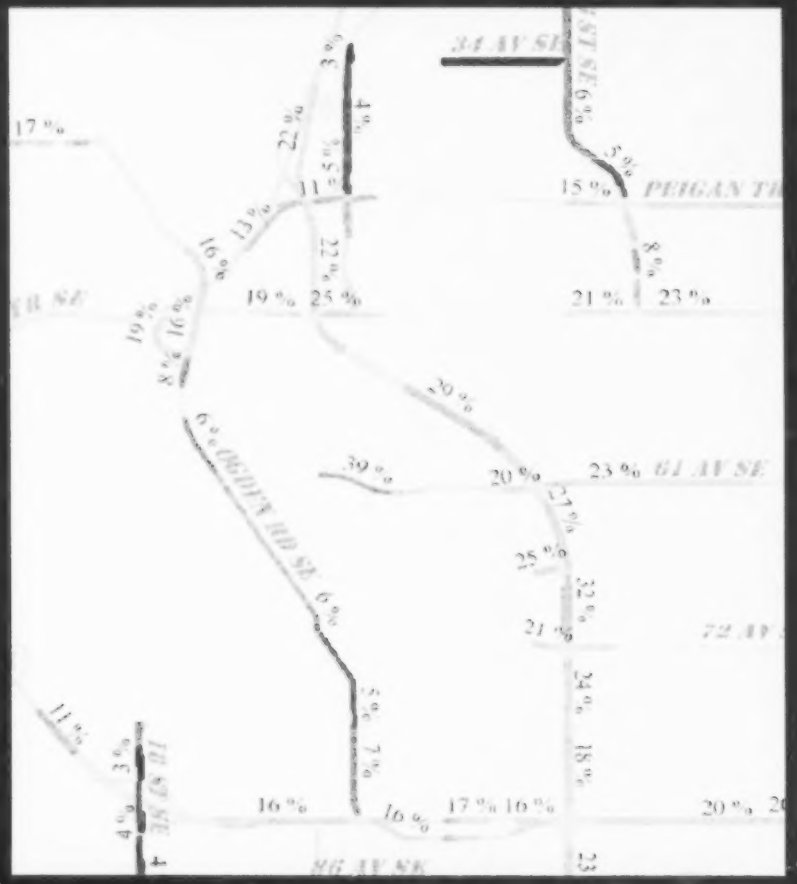
- Southeast Industrial Area
  - 33,000,000 ft^2
  - 80% Warehousing & Distribution
  - 34,200 Jobs
- Limited Access to the area

Traffic Demand

- Average Annual Weekday Traffic 36000 vpd

Traffic Demand

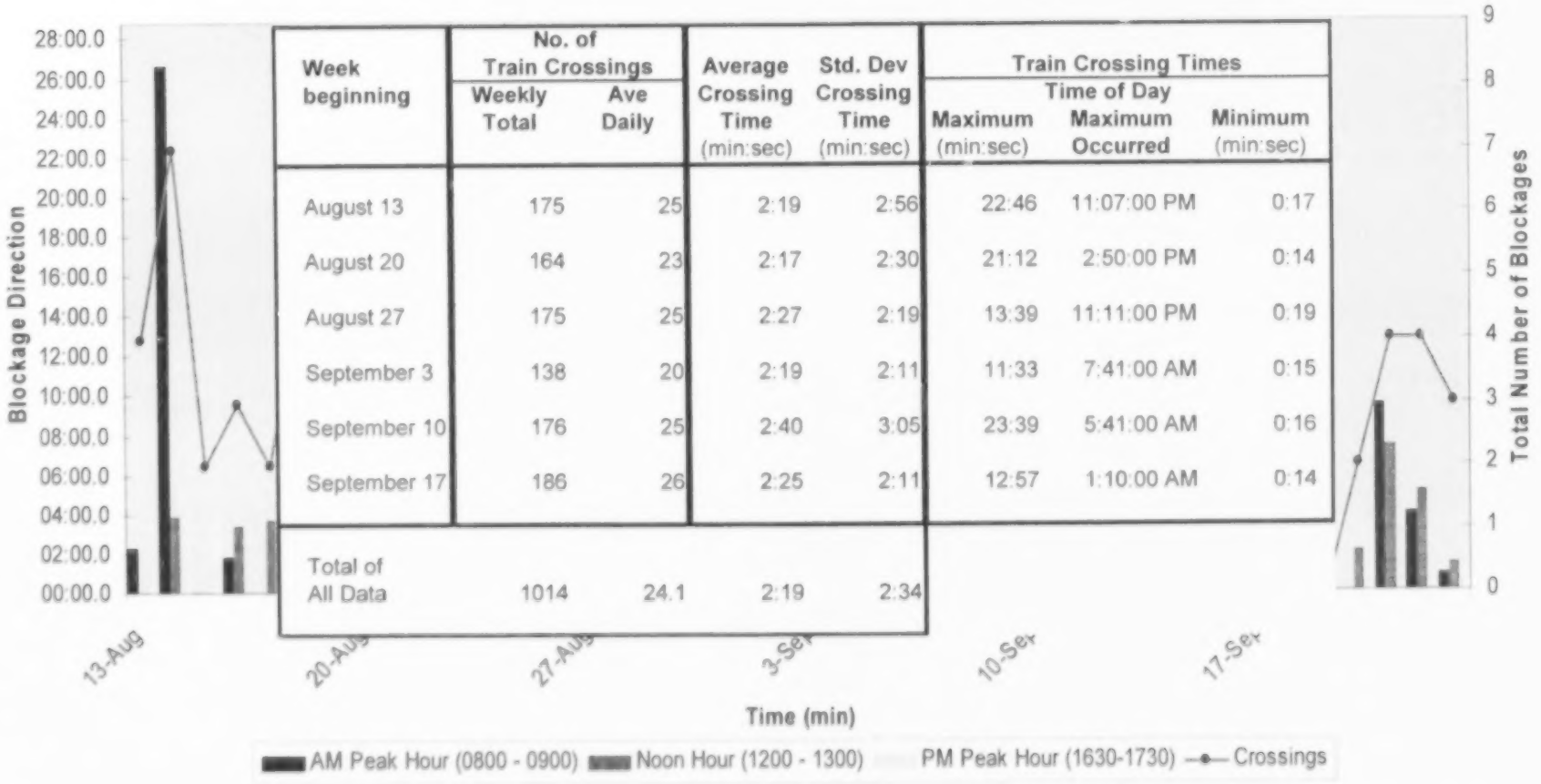
- Average Annual Weekday Traffic 36000 vpd
- High truck volumes (20-30%)



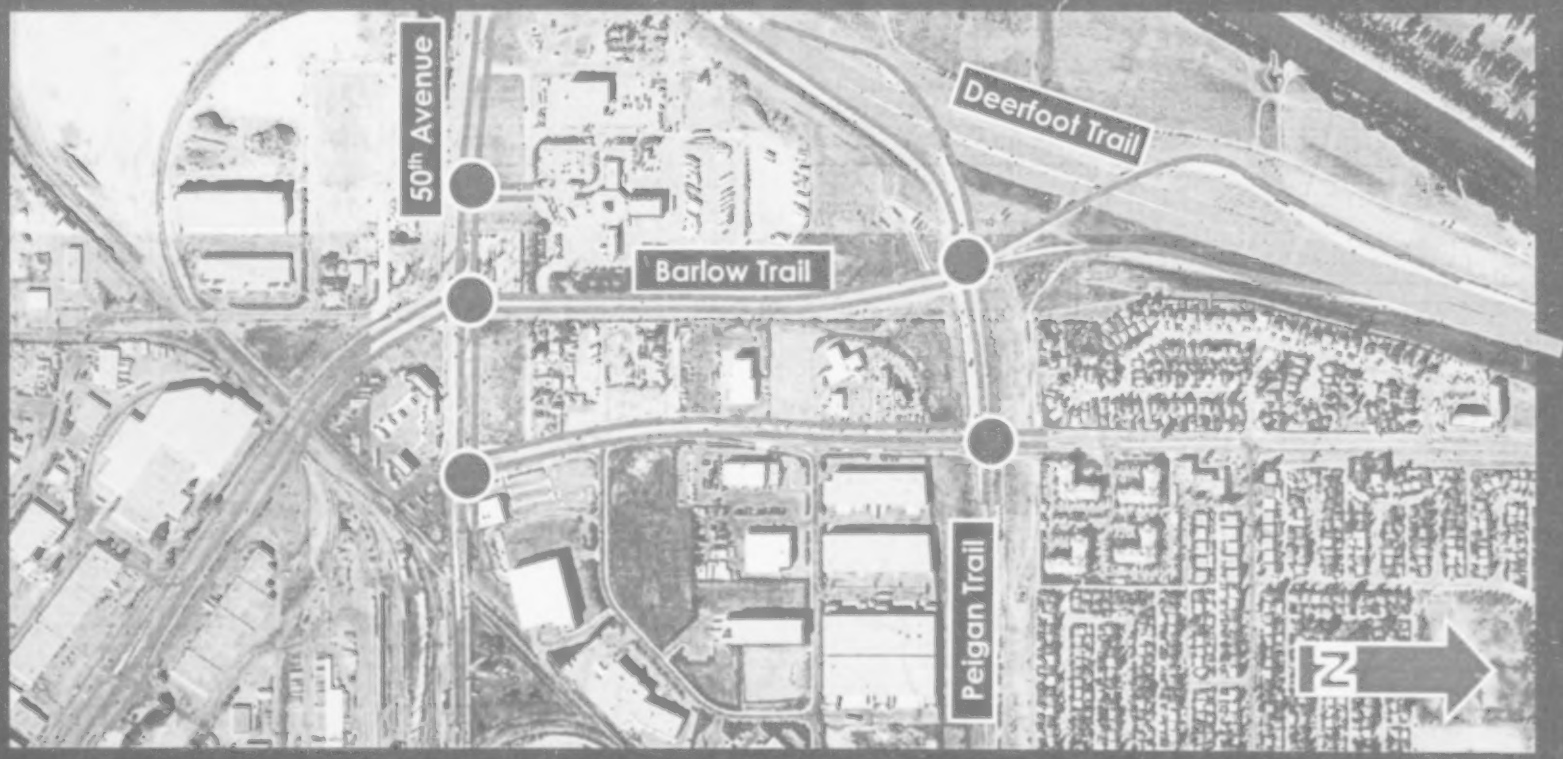
Rail Crossing Demand

Barlow Trail Rail Crossing
Aug 13 to Sept 23, 2000

Week beginning	No. of Train Crossings		Average Crossing Time	Std. Dev Crossing Time	Train Crossing Times		
	Weekly Total	Ave Daily	(min:sec)	(min:sec)	Maximum (min:sec)	Time of Day Maximum Occurred	Minimum (min:sec)
August 13	175	25	2:19	2:56	22:46	11:07:00 PM	0:17
August 20	164	23	2:17	2:30	21:12	2:50:00 PM	0:14
August 27	175	25	2:27	2:19	13:39	11:11:00 PM	0:19
September 3	138	20	2:19	2:11	11:33	7:41:00 AM	0:15
September 10	176	25	2:40	3:05	23:39	5:41:00 AM	0:16
September 17	186	26	2:25	2:11	12:57	1:10:00 AM	0:14
Total of All Data	1014	24.1	2:19	2:34			



Study Area



- Key Roadways
  - Barlow Trail
  - 50th Avenue
  - Peigan Trail
  - Deerfoot Trail

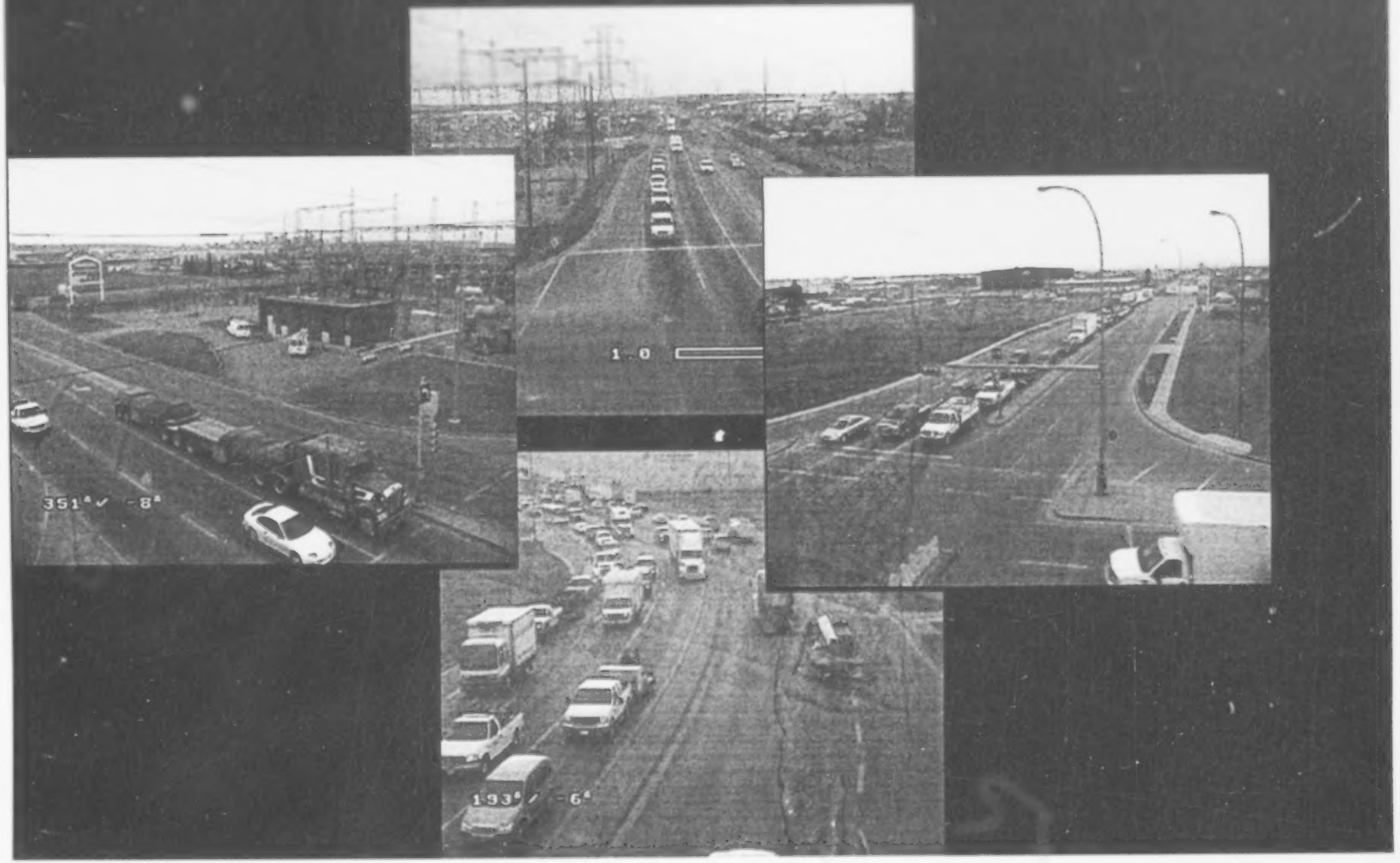
Study Area

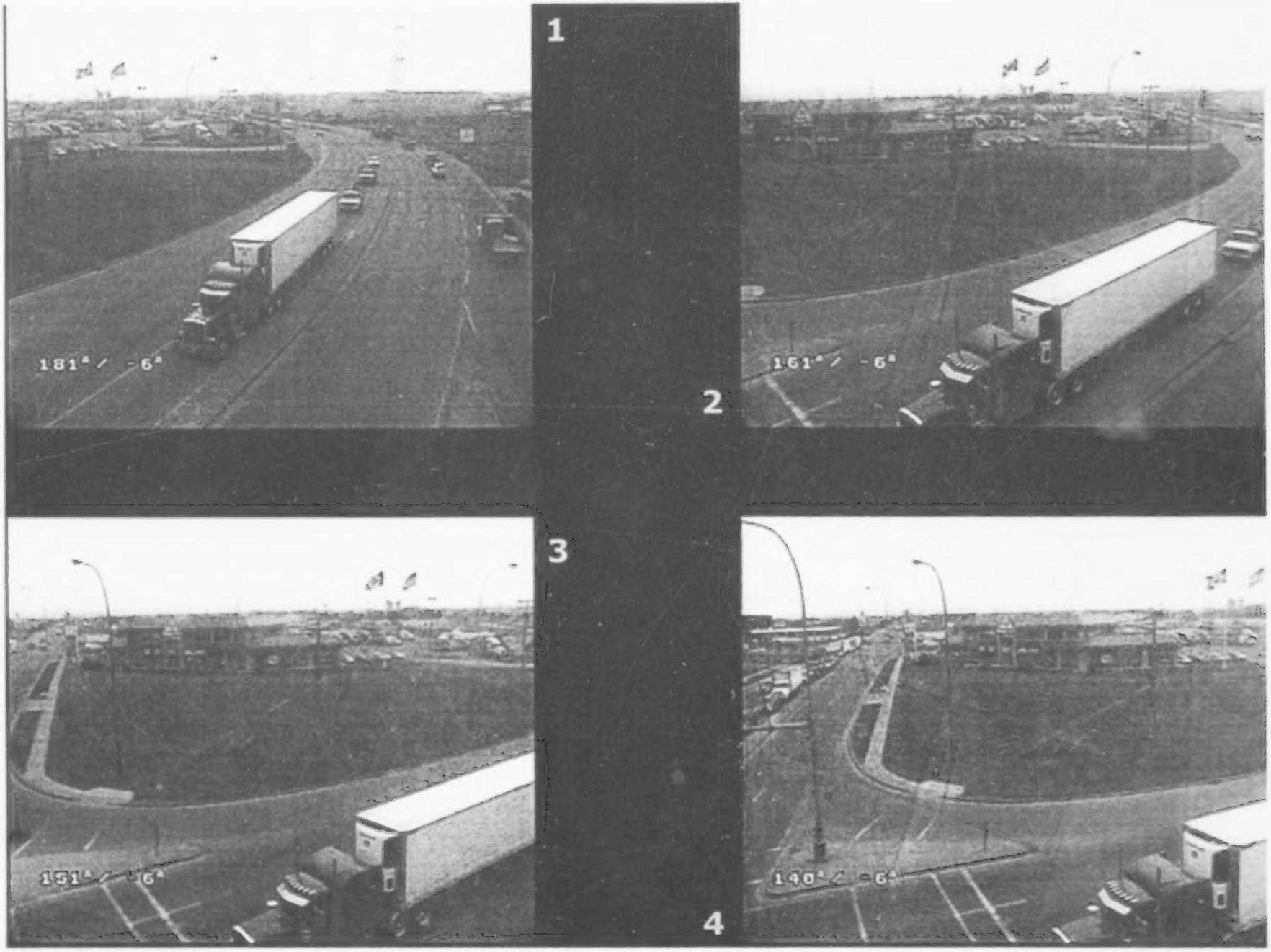
- Control
  - Signalized
  - Unsignalized

Study Area

- Railway
- CN Rail Intermodal Yard

Visual Context

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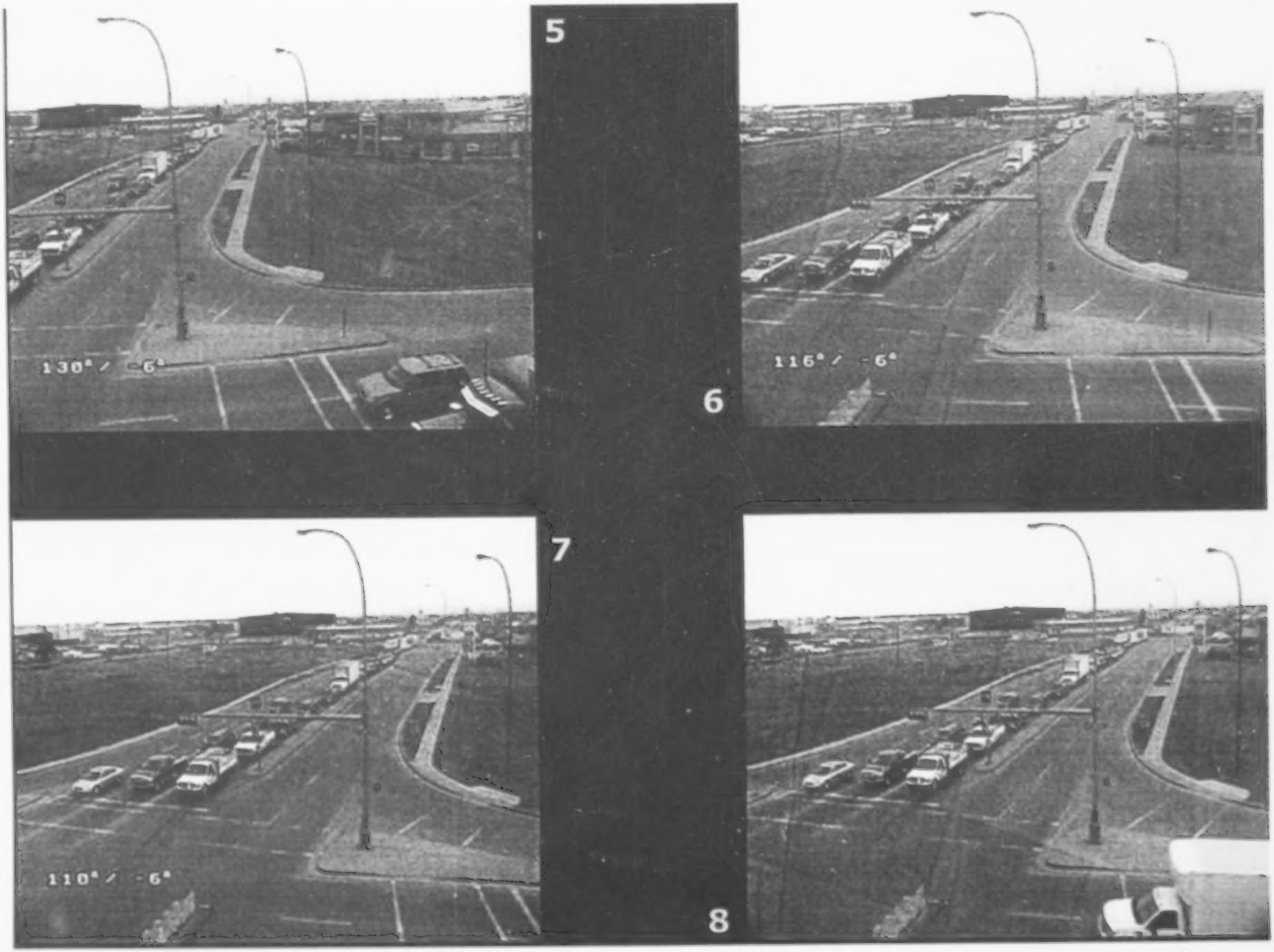
140° / -6°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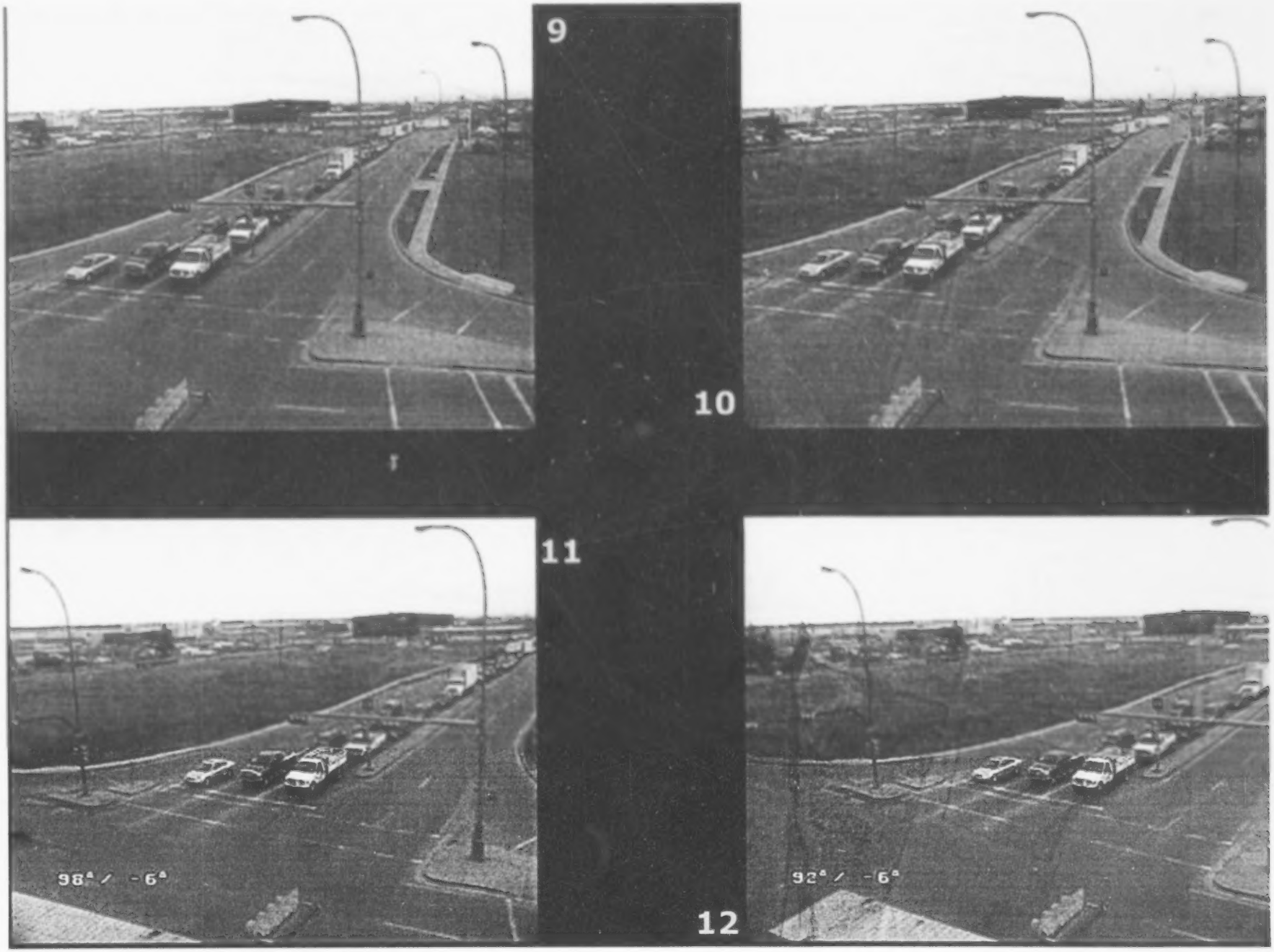
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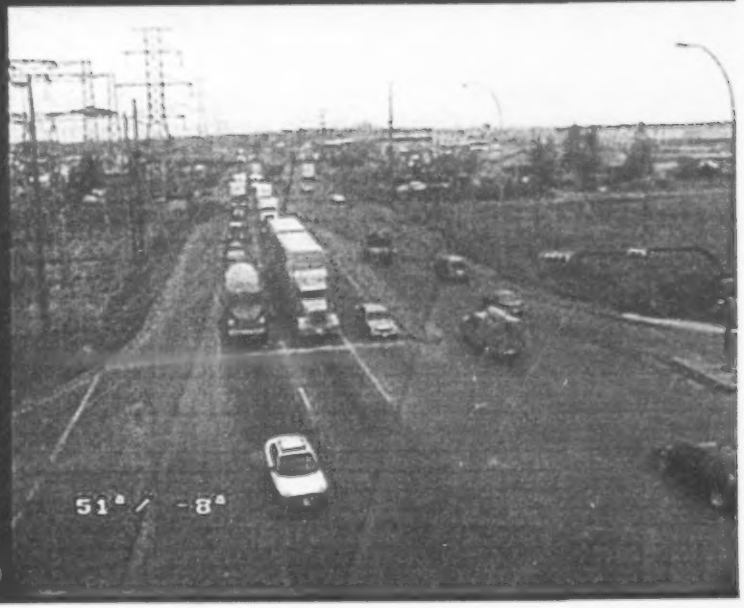
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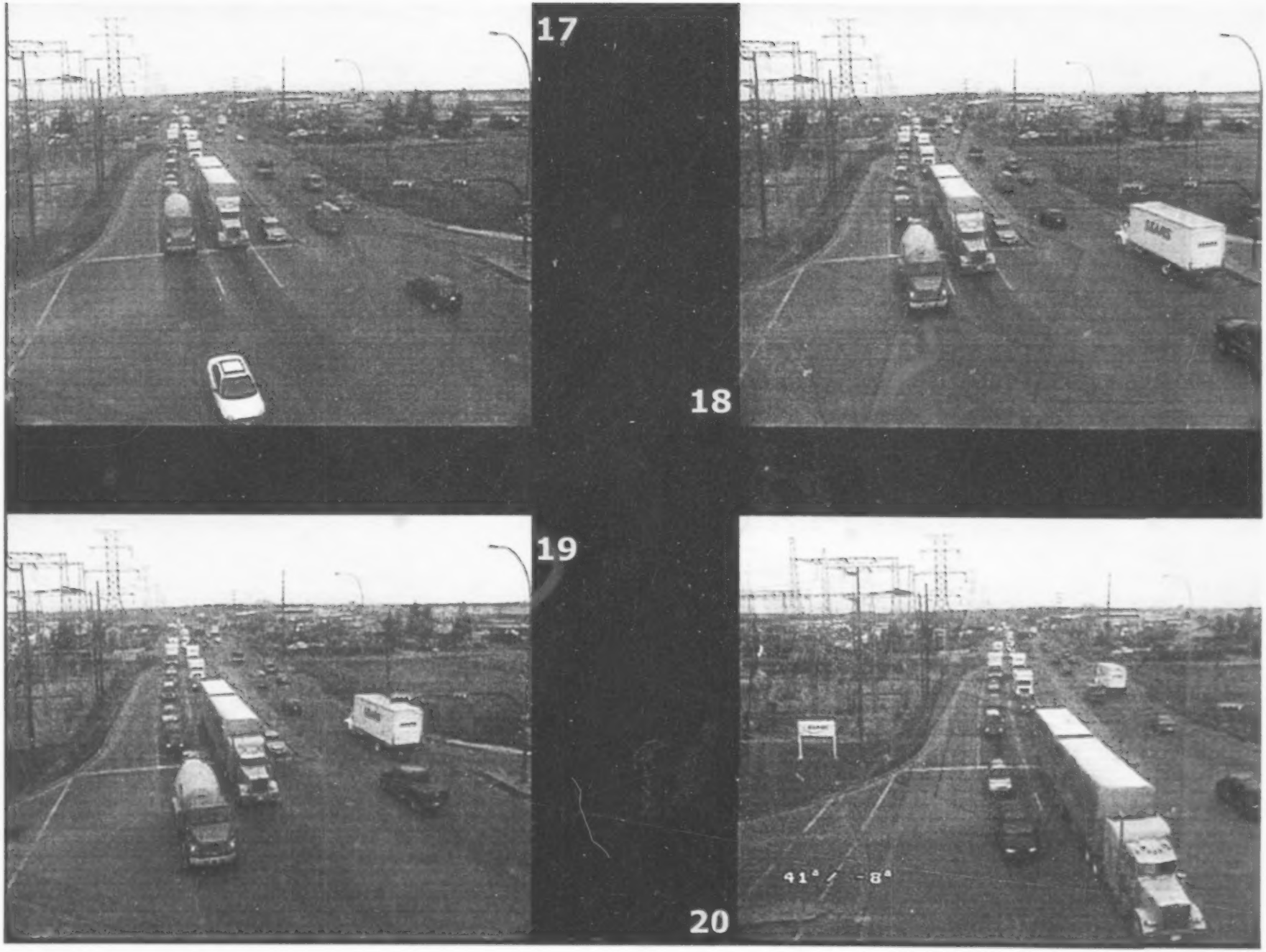
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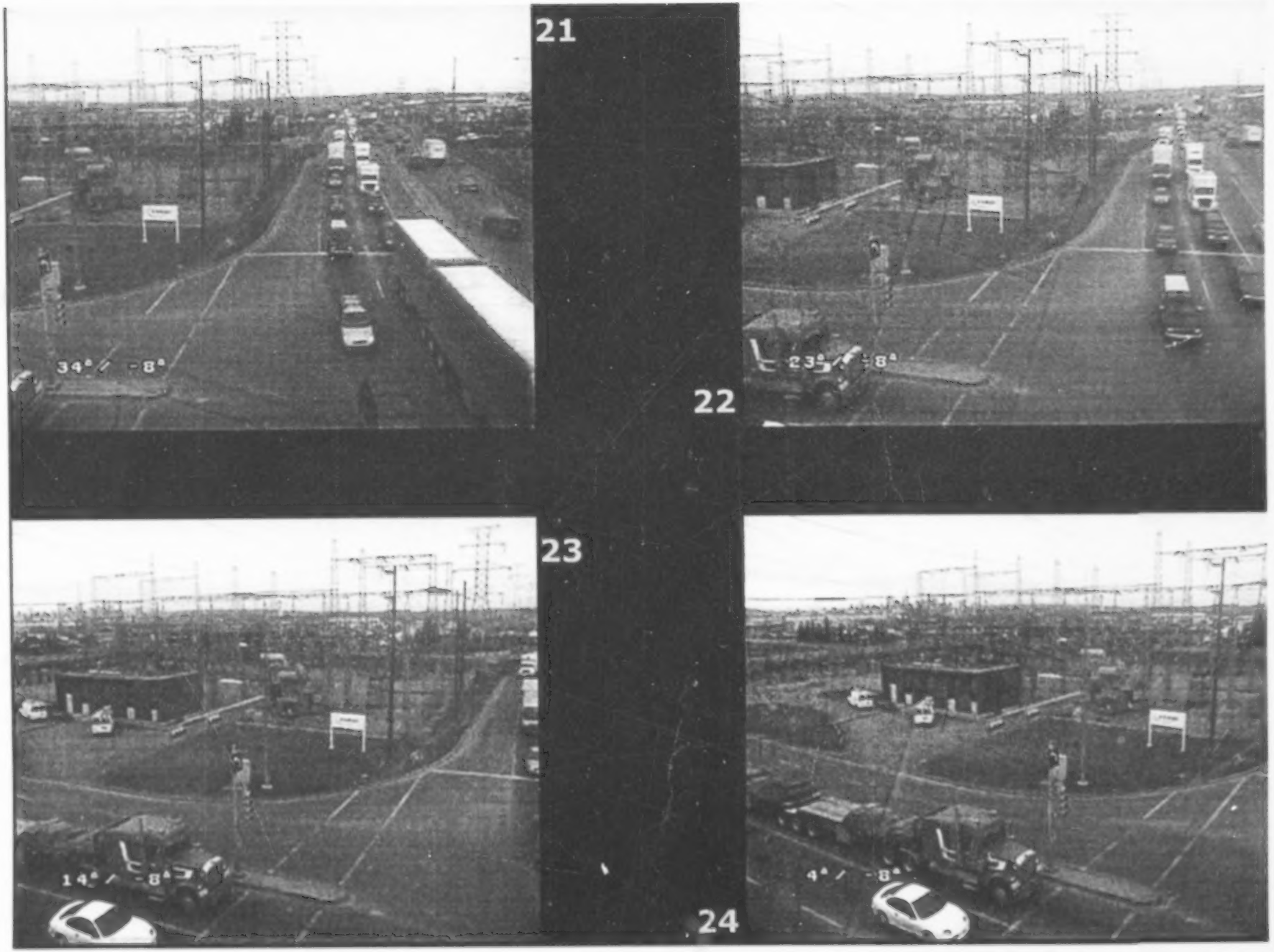
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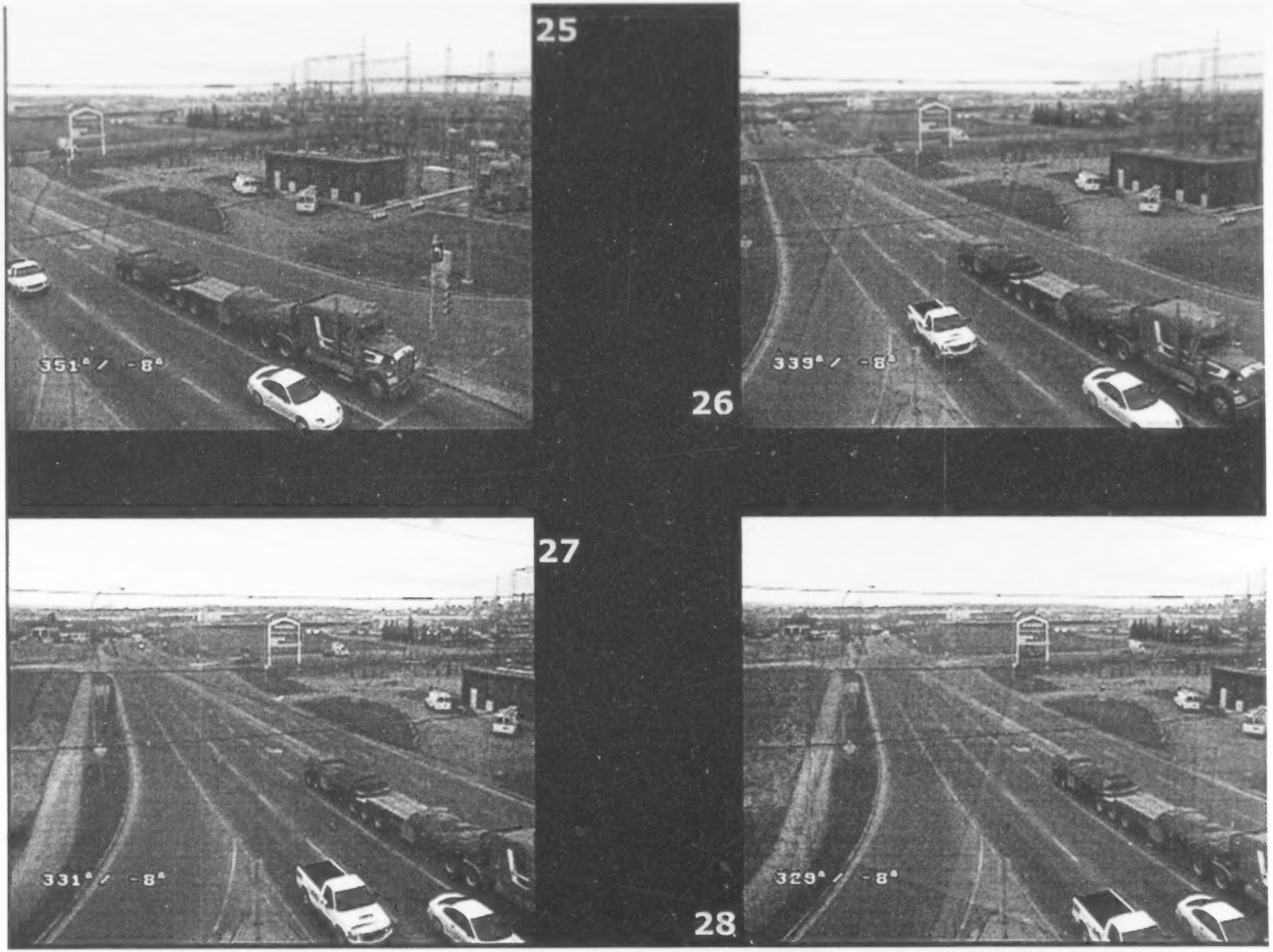
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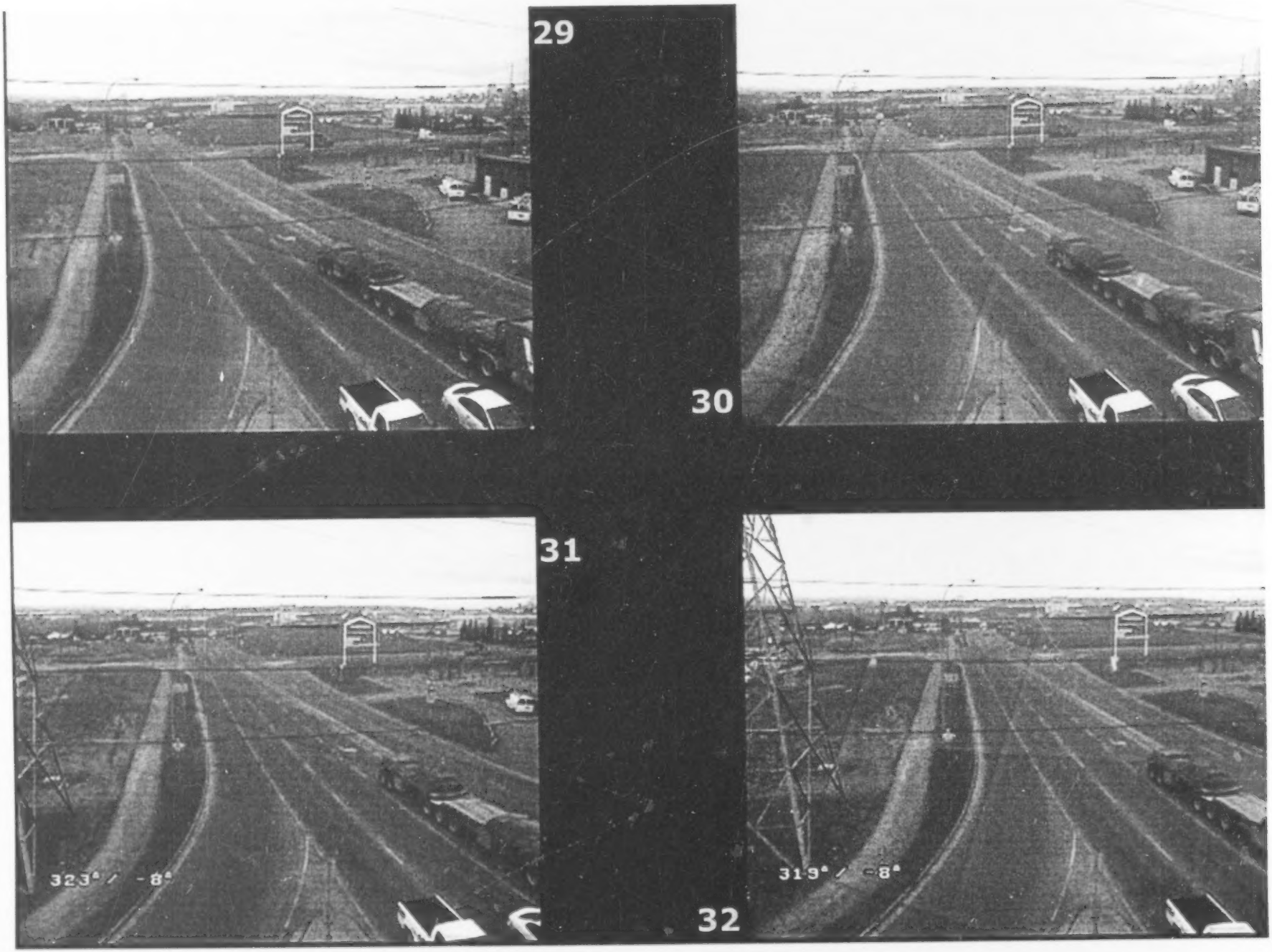
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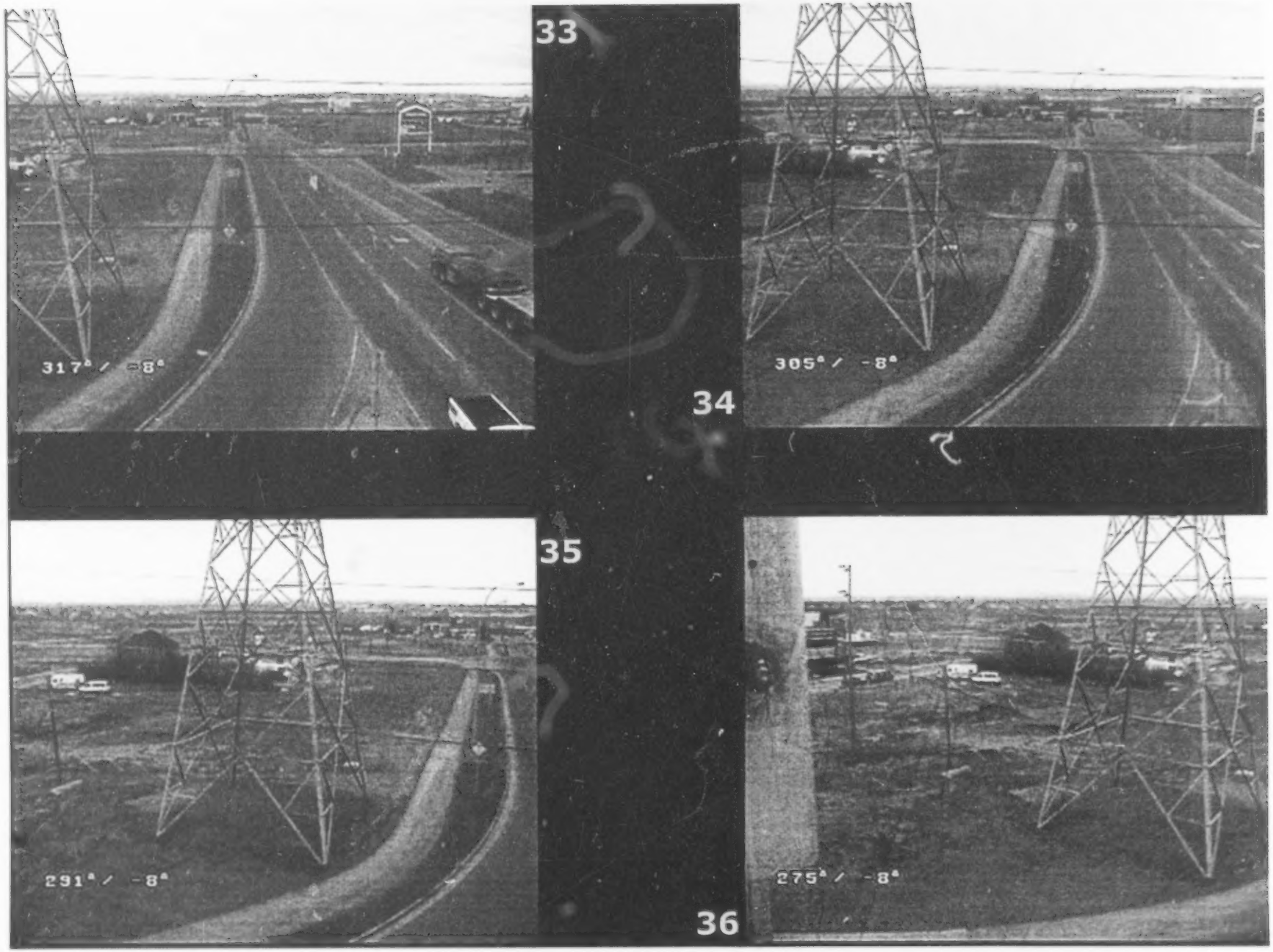
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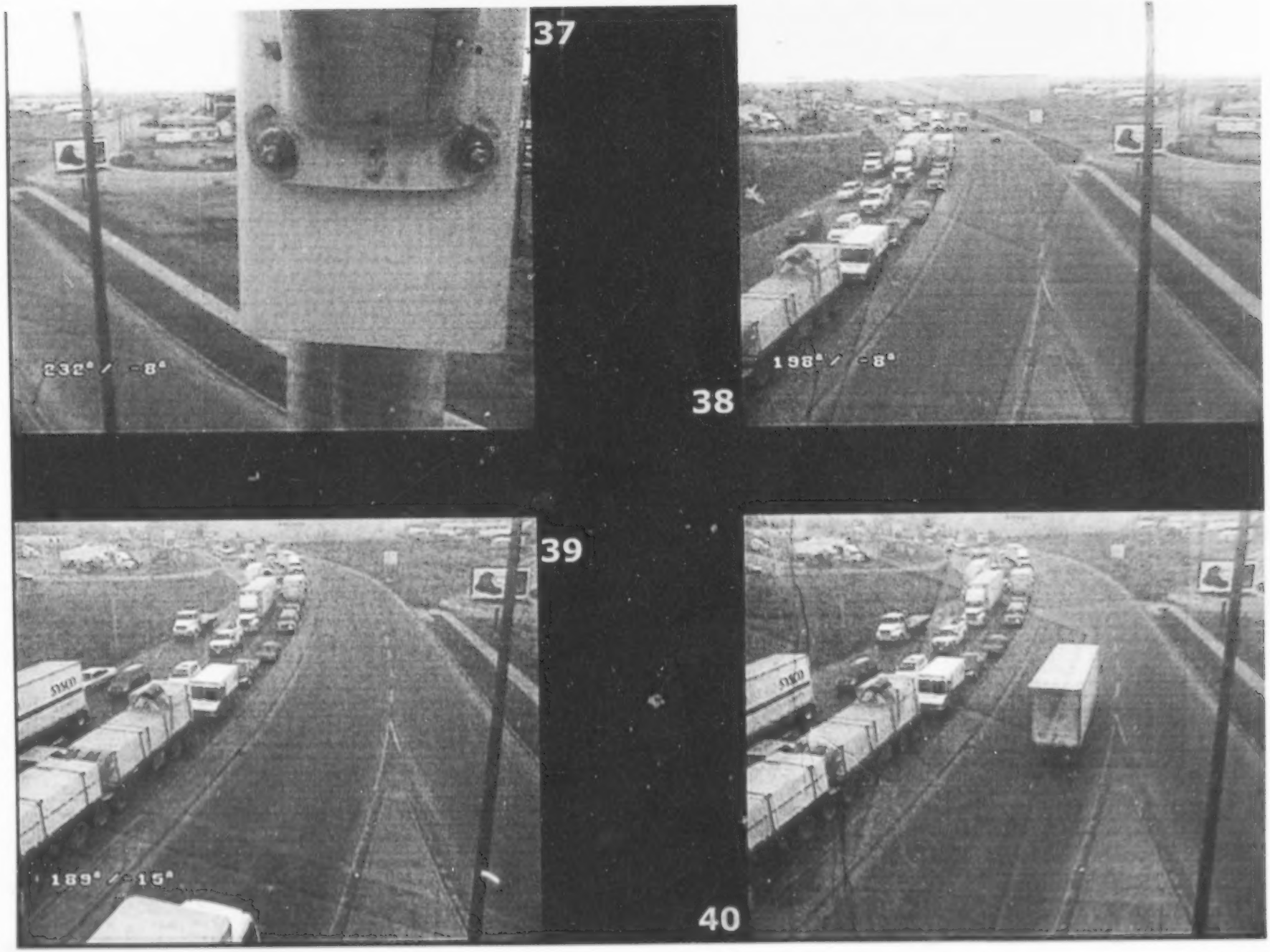
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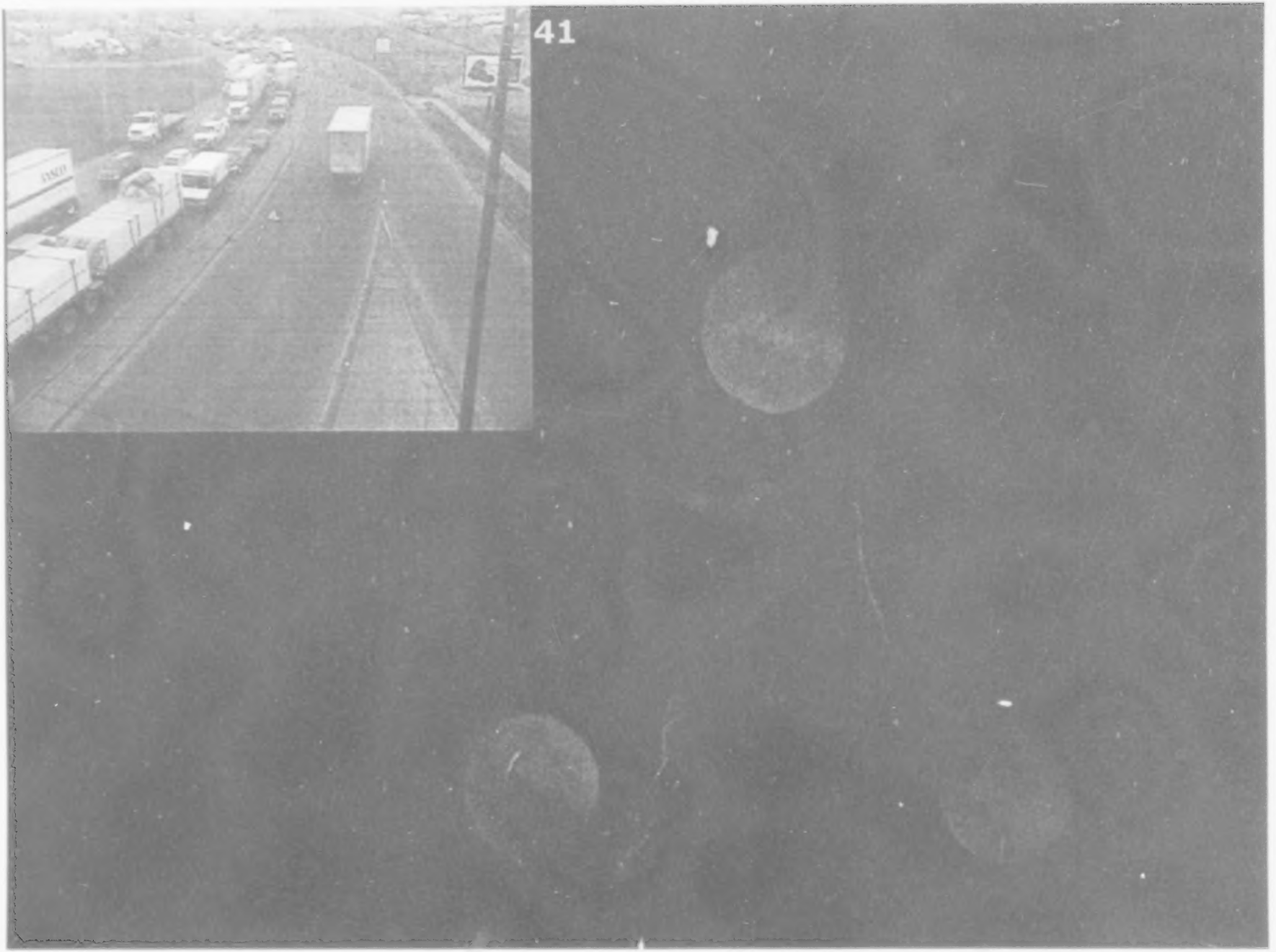
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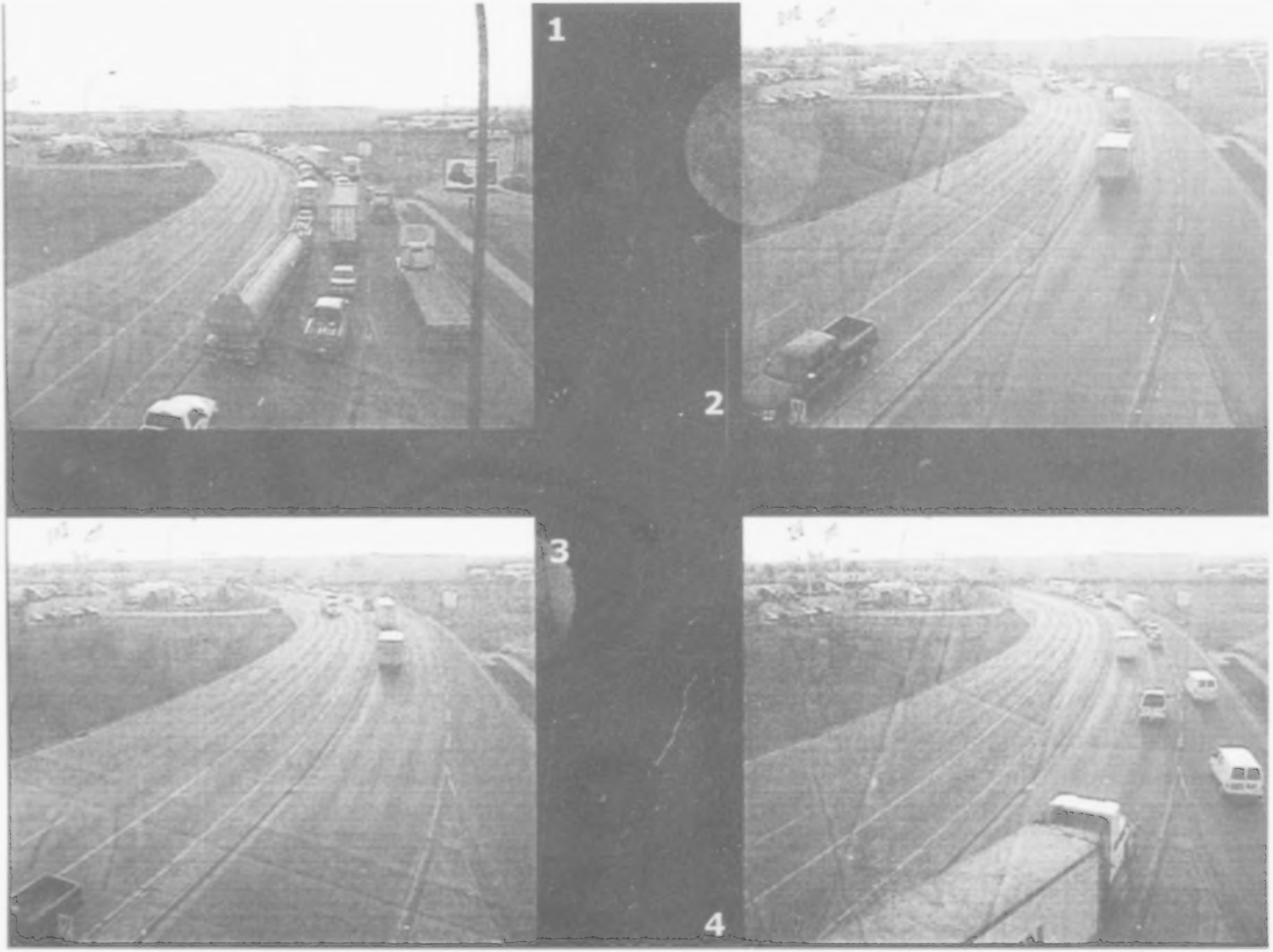
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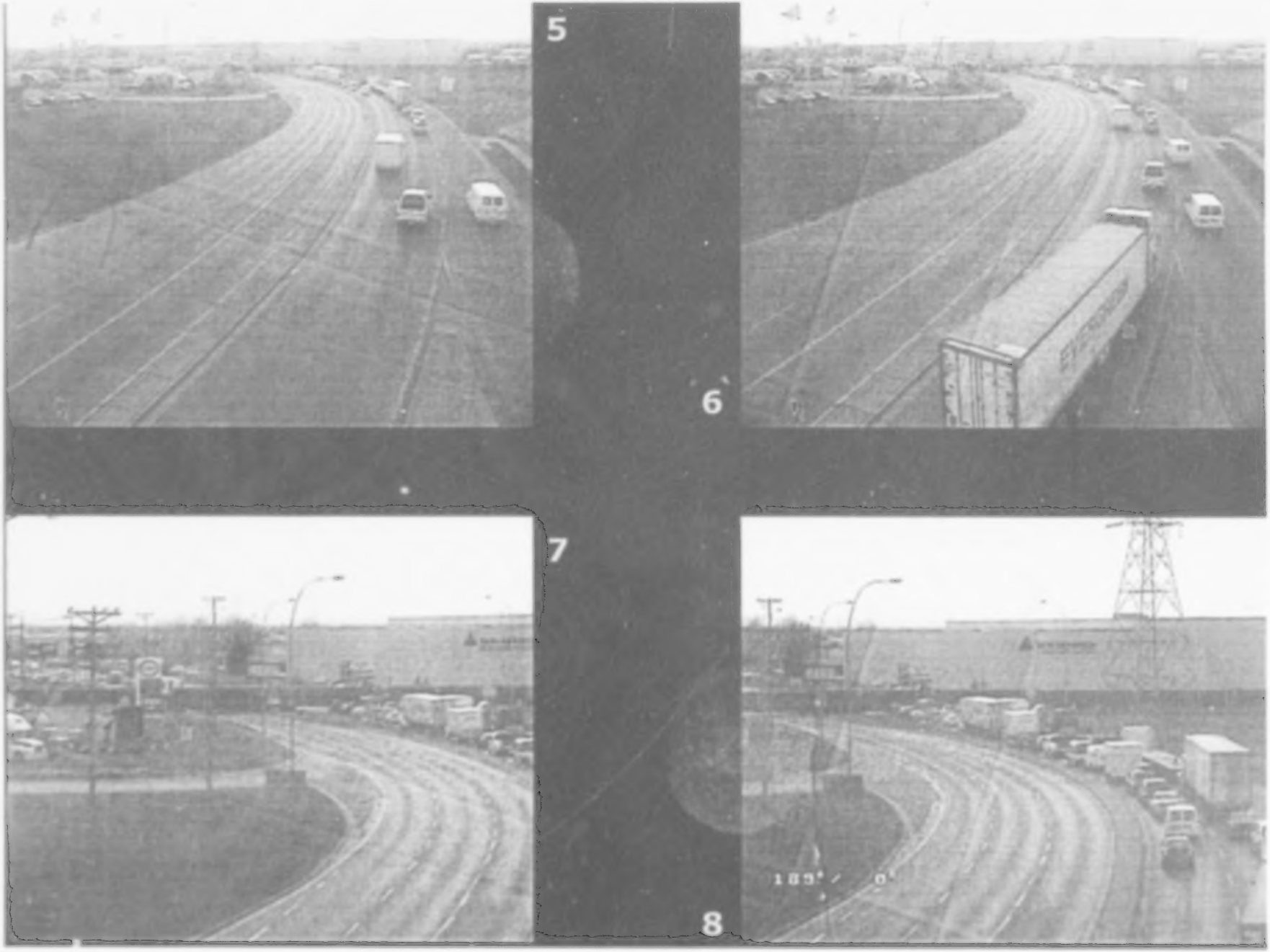
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Problem Statement

- How can traffic delays along Barlow Trail, due to rail operations, be reduced?

Measures of Success

- Barlow Trail vehicle delay reduction
- Amount of Diversion
- Queue Length reduction
- Travel time improvement

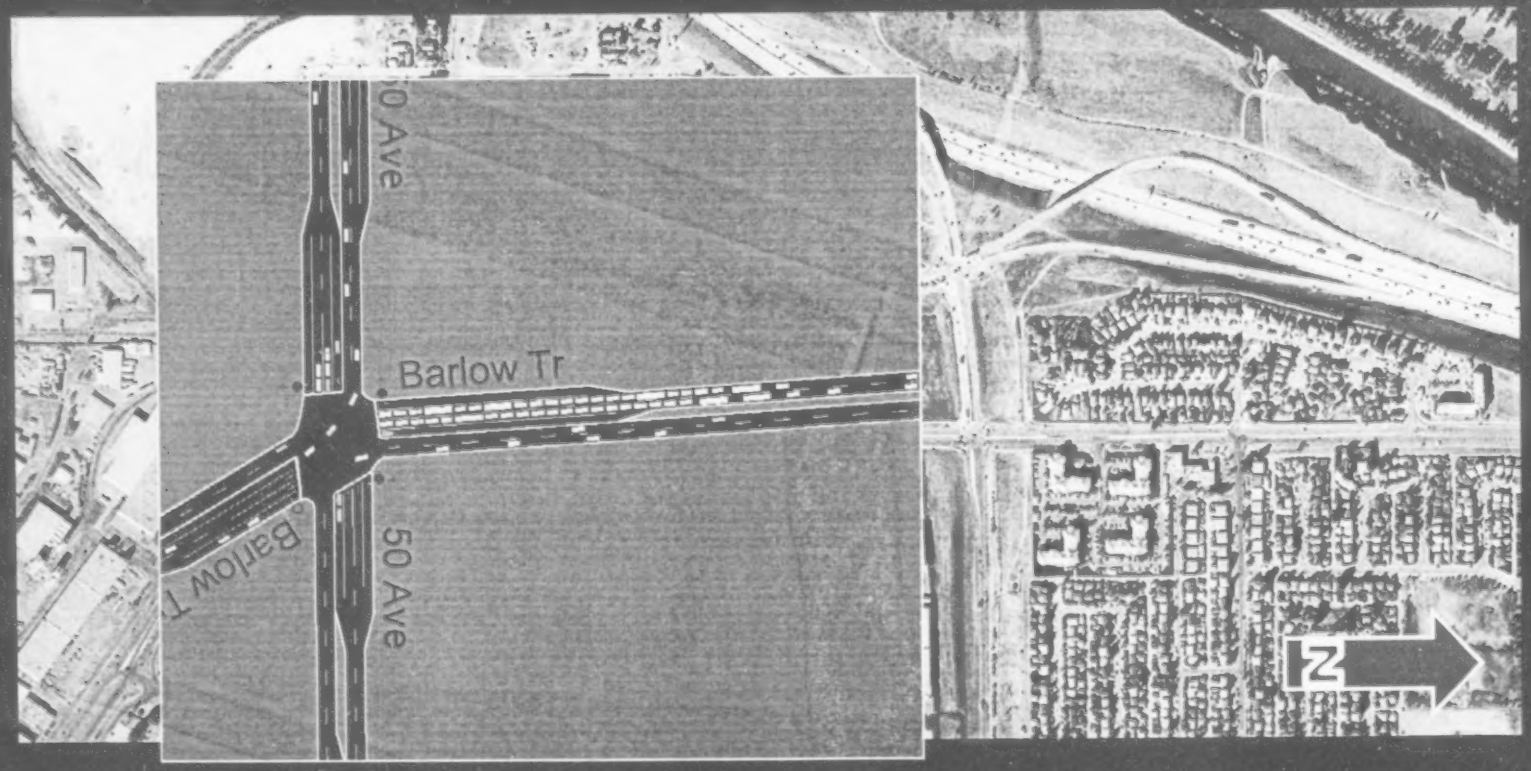
Solutions

- Optimization of current timings
- Alter rail operations
- Grade separation $14 - 17 million
- **ITS Solution $650,000**

Analysis

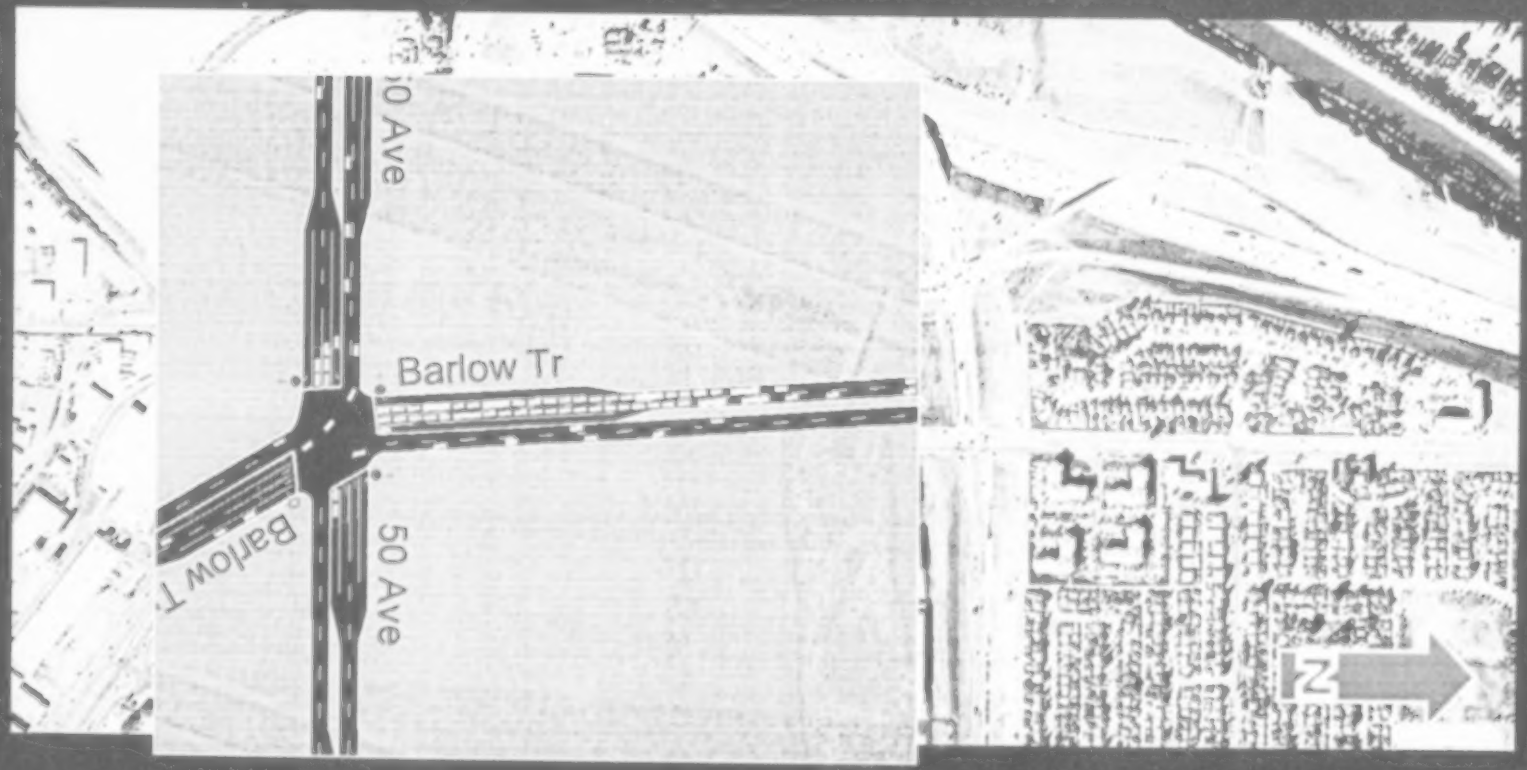
- Data Collection
  - Gate crossing recording
  - Traffic counts
- Various analysis tools
  - Synchro version 5
  - Paramics Microsimulation

Considerations



- Diversion Options - Southbound Left Queuing
- Westbound Left Blockage
- Capacity Along 50th Avenue

Considerations



- Diversion Options - Southbound Left Queuing
- Westbound Left Blockage
- Capacity Along 50th Avenue

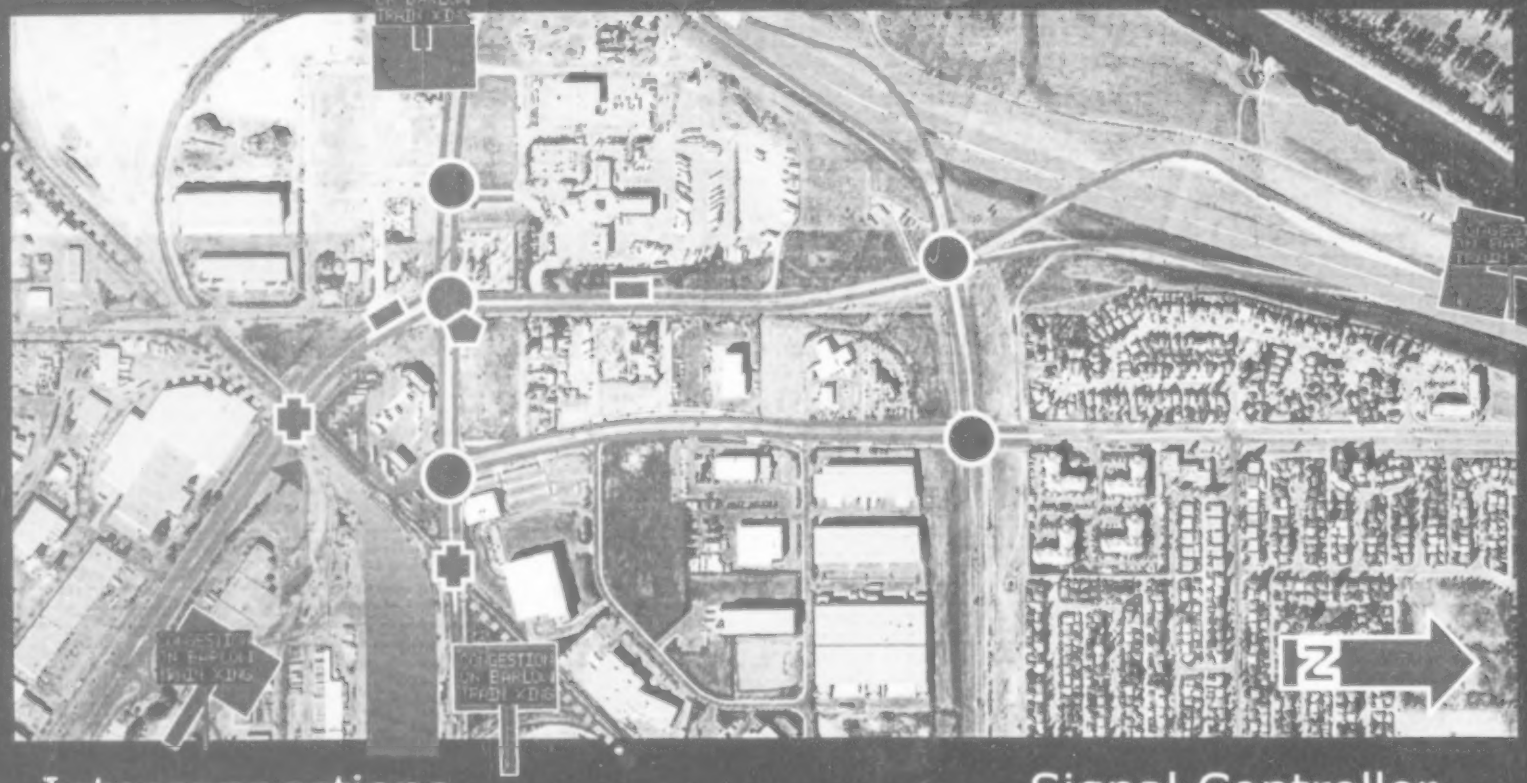
Considerations

- Northbound Deerfoot Ramp Backup
- Westbound Left

Intelligent Transportation Solution

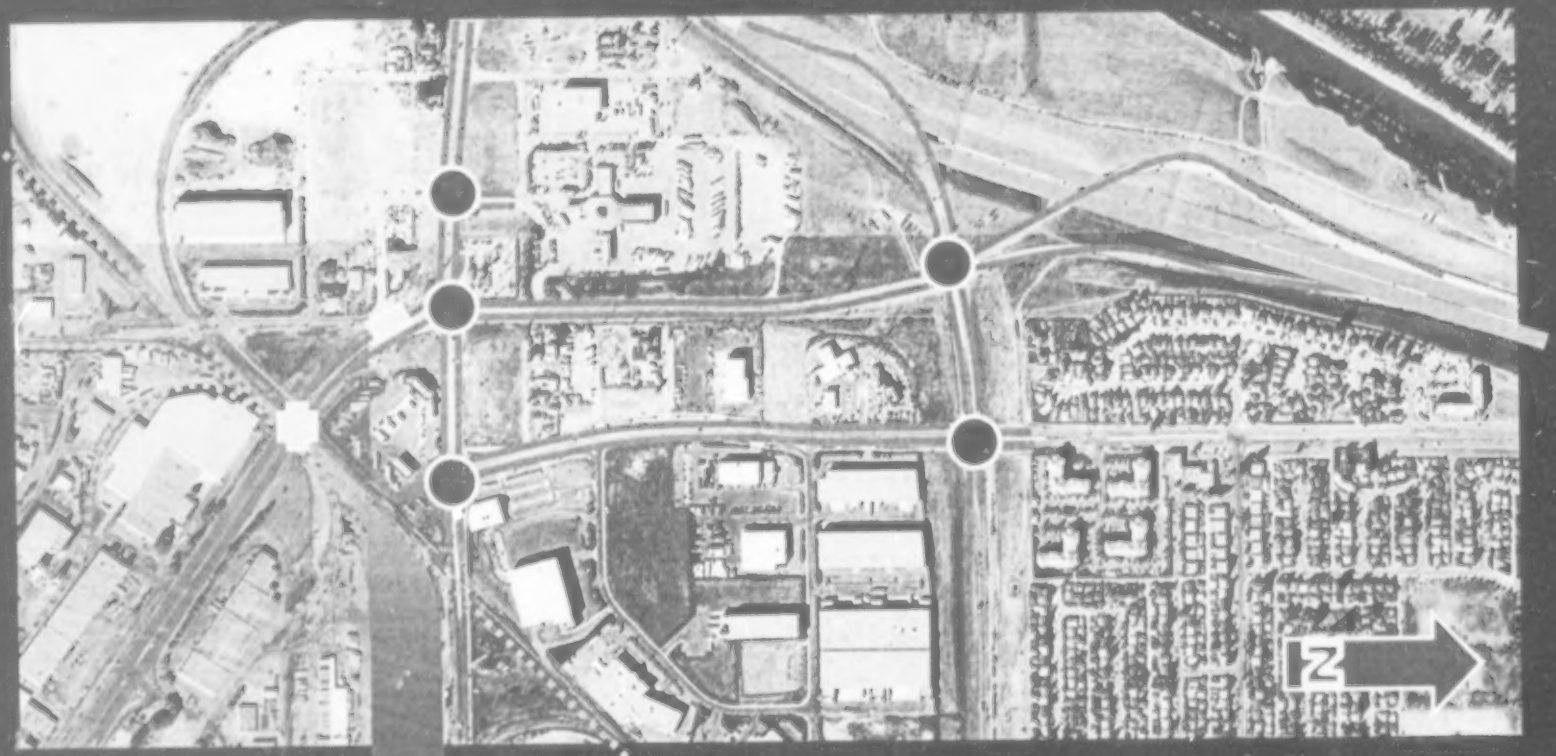
- Three Components:
  - Blockage Traffic Control
    - Revised control to move traffic with one leg out of service
  - Clearance Timing
    - Provide special control for clearing queues
  - Traveler Information
    - Provide information at key diversion points to alter drivers

Equipment



- Interconnections
- Detection Zones (Camera / Loops)
- Blank Out Sign
- Variable Message Signs
- Signal Controller

Mode: Regular Operation

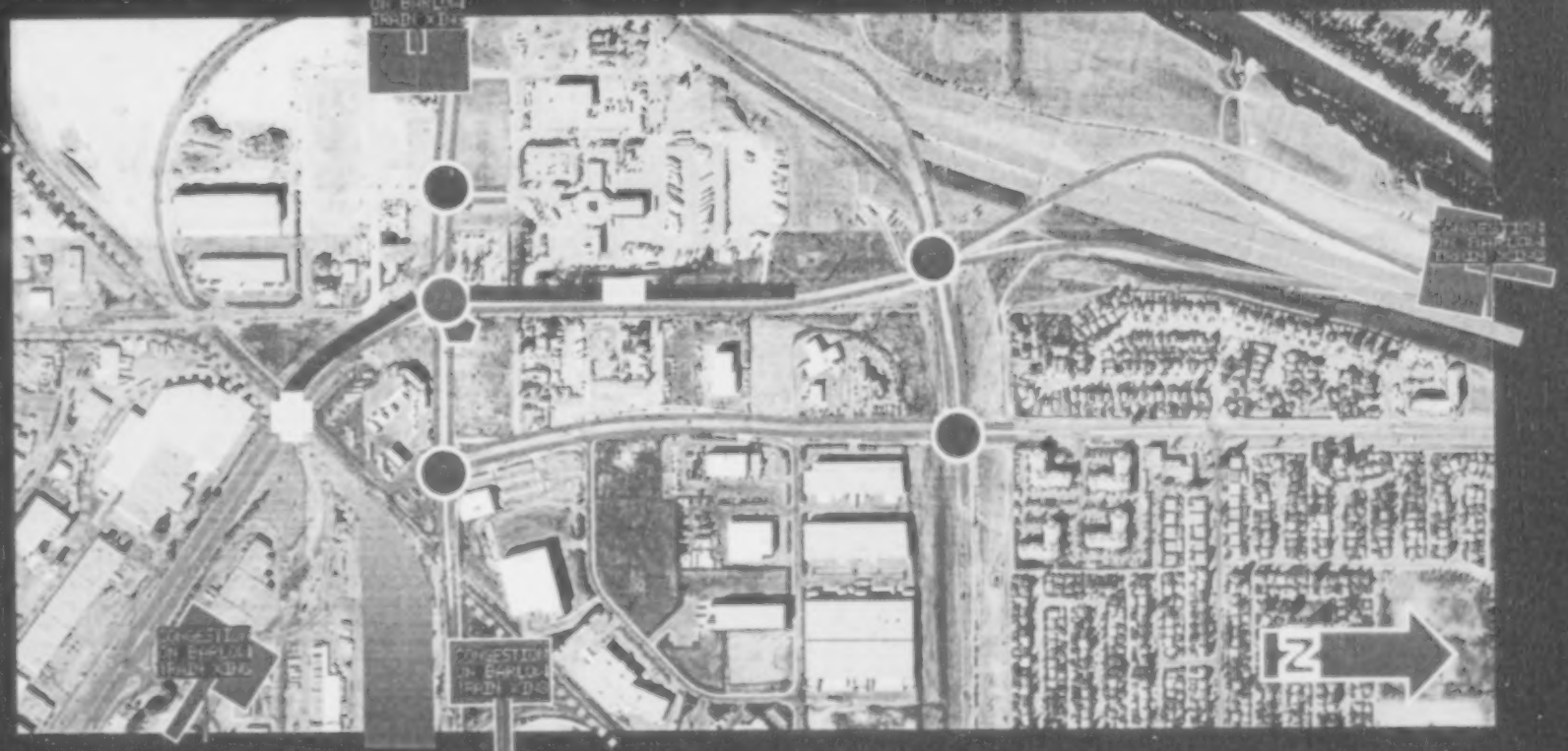


- Polling Interconnections
- Regular Signal Phasing & Timing
- *Train Blocks Crossing*
- Transition to Queue Detection
  - Detector one activated

Mode: Queue Detection

- Polling Detector one
- Regular Signal Timing & Phasing
- *Queue Grows*
- Detector One Tripped
- Transition to Blockage Mode
  - Blank out Sign
  - Message Signs
  - Deactivate detector one
  - Blockage Phasing / Timing

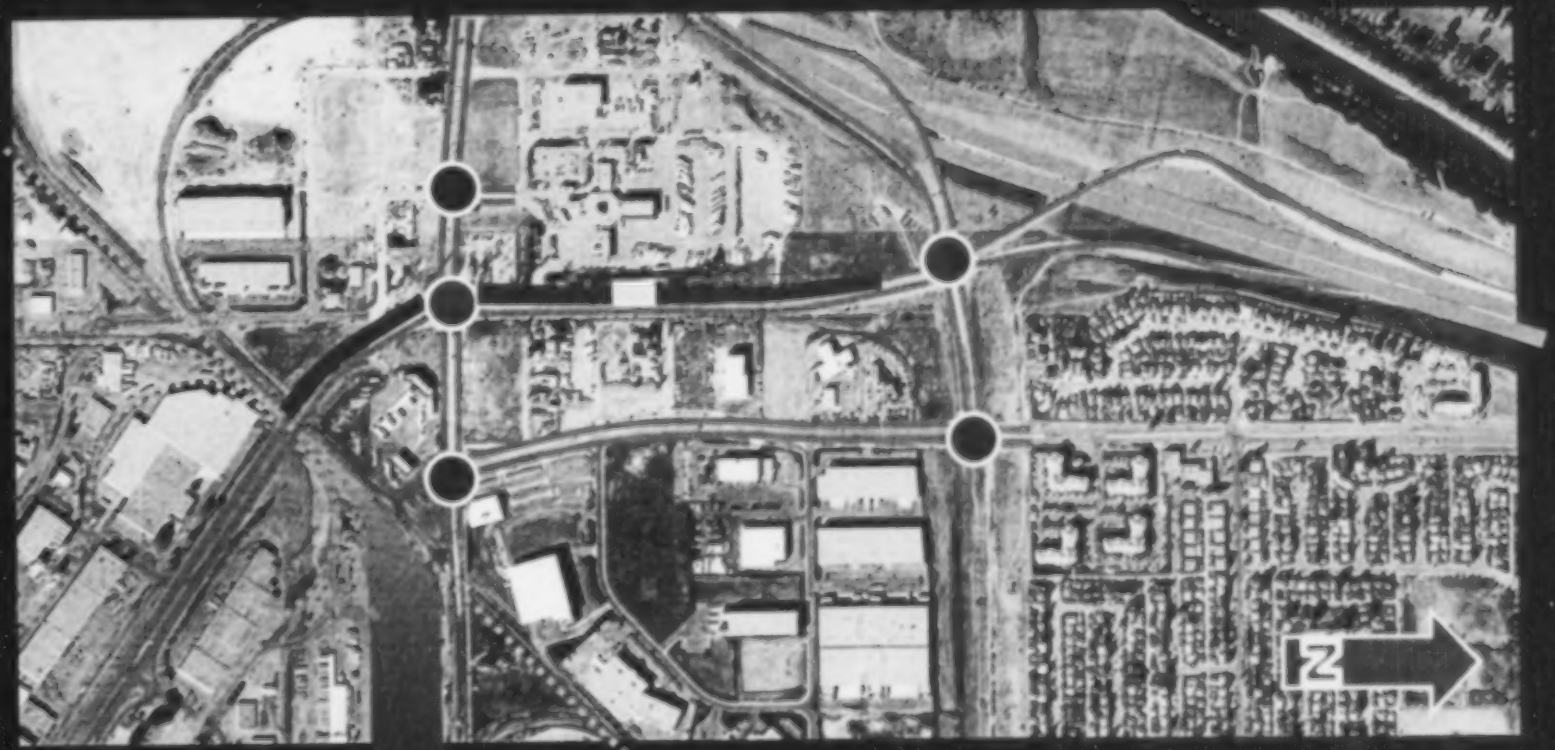
Mode: Blockage Mode



- Polling Interconnects
- Blockage Timing & Phasing
- *Queue continues to grow*
- *Train clears crossing*

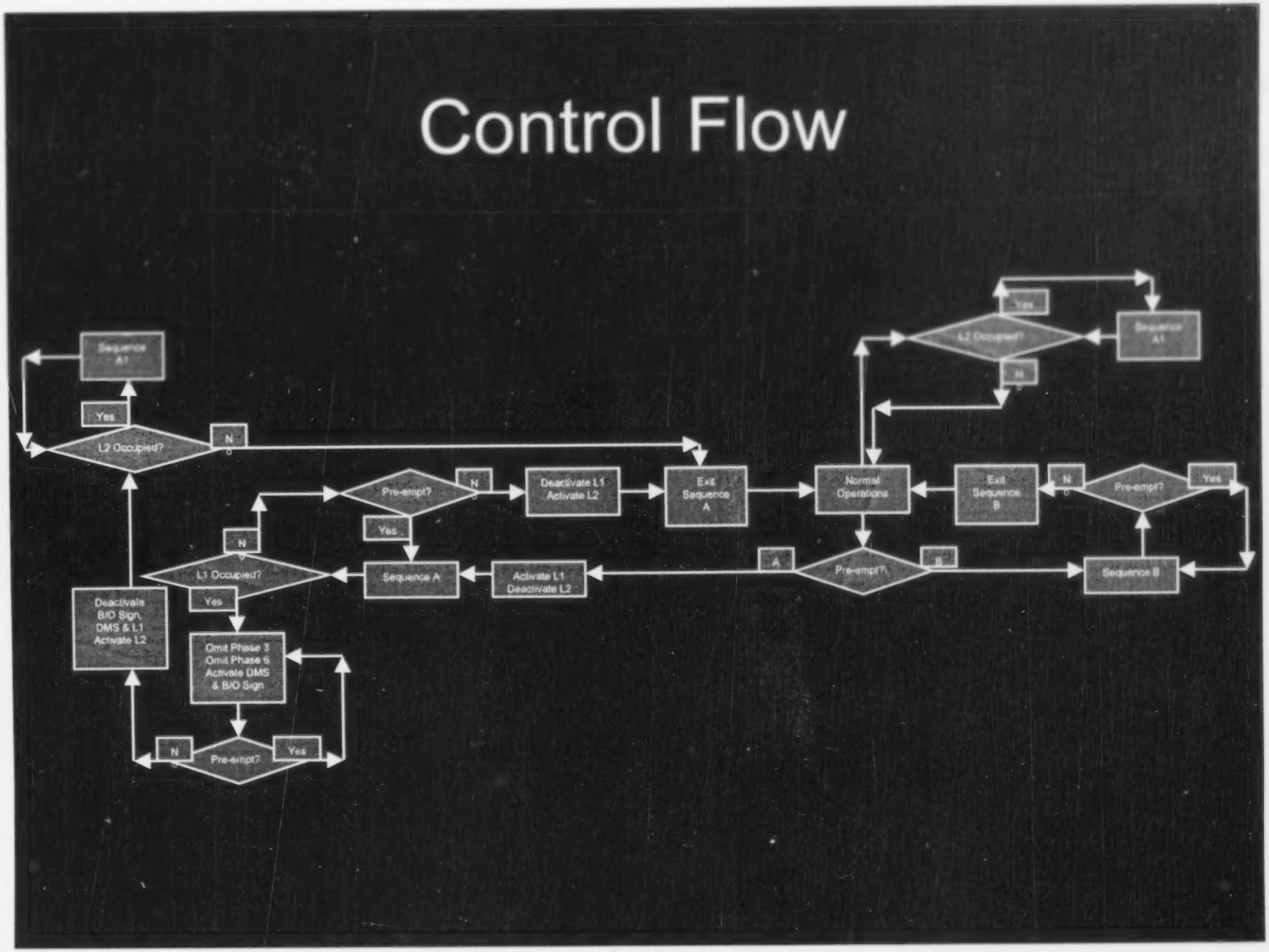
- Transition to Clearance Mode
  - Detector two activated
  - Turn off blank out signs
  - Turn off message signs
  - Clearance phasing / timing

Mode: Clearance

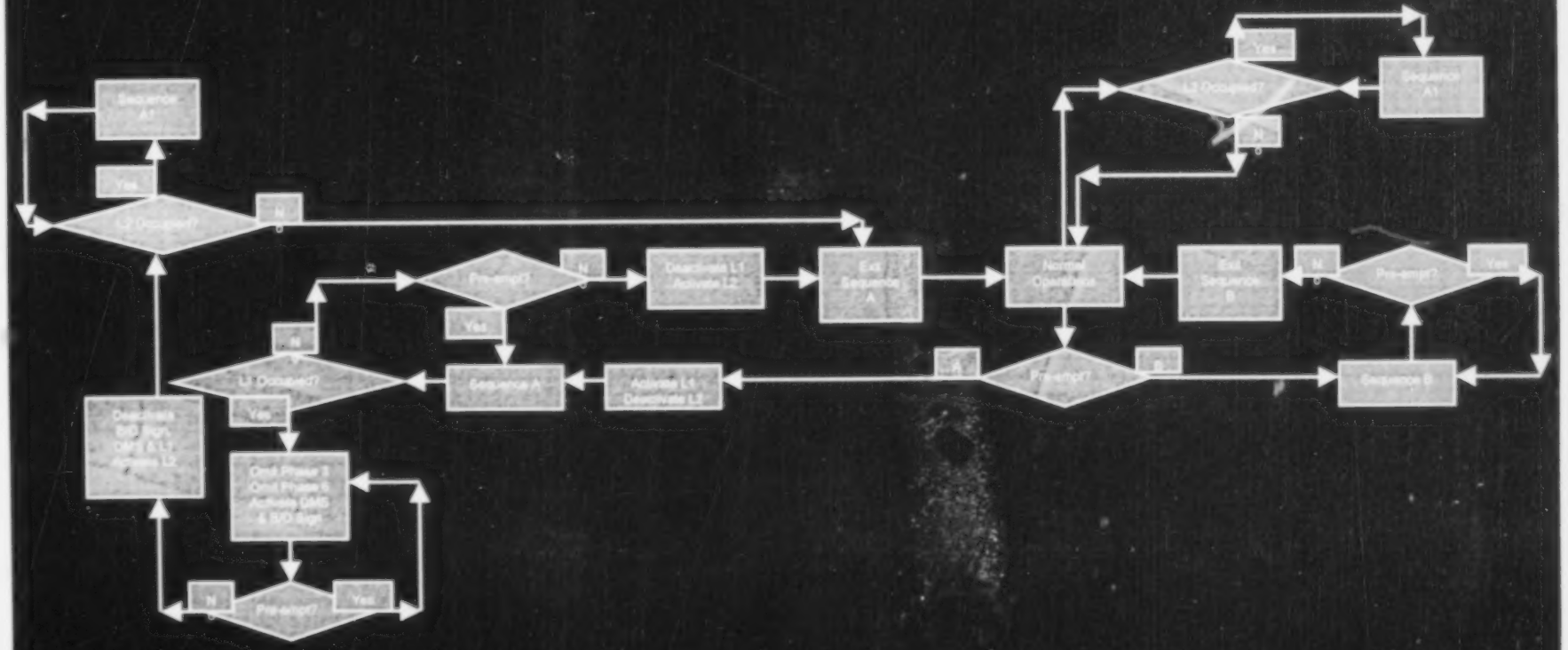


- Polling Detector two
- Clearance timings
- *Queues shrink*
- Detector two clear
- Revert to regular operation

Control Flow



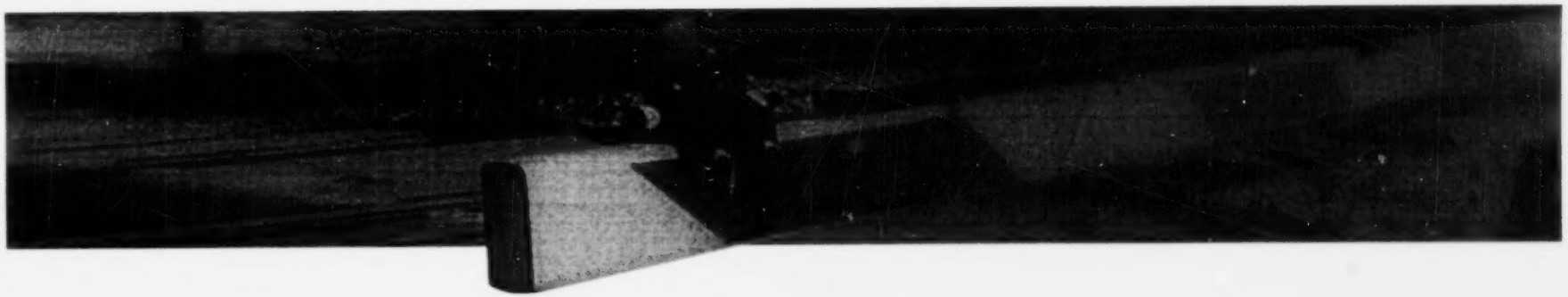
Control Flow



Progress to date

- CN Rail interconnect
- Monitoring Camera
- New Controller Installation
- Central Communications

Questions



Public Education and Enforcement Research Study

Suzanne Sposato
Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, Massachusetts, USA

Abstract

The Public Education and Enforcement Research Study (PEERS) is a cooperative effort between the Federal Railroad Administration (FRA), the Illinois Commerce Commission (ICC) and local communities in the state of Illinois. Each participating community is responsible for constructing and implementing highway-rail grade crossing safety programs that are funded jointly by the FRA and ICC. Under the PEERS program, the Volpe Center was tasked to evaluate the effectiveness of education and enforcement initiatives at eight selected highway-rail grade crossings in three communities.

The Volpe Center's evaluation of the PEERS program is scheduled to last 16 months. There are 2 months of base case data, 12 months of test case data and 2 months of post-test case data anticipated to be collected during the conduct of this research. During the test case period, each community commits to implement safety

initiatives to inform the public of dangers at highway-rail grade crossings and enforce existing laws. The effectiveness of these programs will be measured by counting the number of drivers and pedestrians who violate the crossing warning devices. Preliminary results from one community indicate that the PEERS program had a positive impact on driver and pedestrian behavior at highway-rail grade crossings.

the VOLPE center

Public Education and Enforcement Research Study

Suzanne Sposato
Volpe National Transportation Systems Center
November 22, 2004

PEERS Project Overview

The Public Education and Enforcement Research Study (PEERS) is a cooperative effort between the FRA, the ICC, and 23 Illinois communities. Under the PEERS program, the Volpe Center was tasked to evaluate the effectiveness of education and enforcement initiatives at eight selected highway-rail grade crossings in three Illinois communities.

the VOLPE center

PEERS Project Overview

16-month video monitoring period

- Baseline case data collection period (2 months)
- Test case data collection period (12 months)
- Post-test case data collection period (2 months)

Initiatives during test case period

- Scheduled police information and enforcement blitzes
- Community public awareness campaigns
  - Trooper-on-a-train program
  - Operation Lifesaver presentations
  - Poster campaigns

PEERS Project Participants

- Illinois Commerce Commission
- Federal Railroad Administration
- Illinois Operation Lifesaver
- **Arlington Heights**
- **Bartlett**
- **Macomb**
- Decatur
- Desplaines
- Dixmoor
- Dolton
- Downers Grove
- Elburn
- The Volpe Center
- Union Pacific
- Evergreen Park
- Frankfort
- Galesburg
- Glenwood
- Healthworld
- Lagrange
- Lansing
- Mount Prospect
- Mount Vernon
- Naperville
- North Chicago
- Park Ridge
- Western Springs
- Metra Commuter Railroad
- Burlington Northern Santa Fe

Communities Involved

Arlington Heights

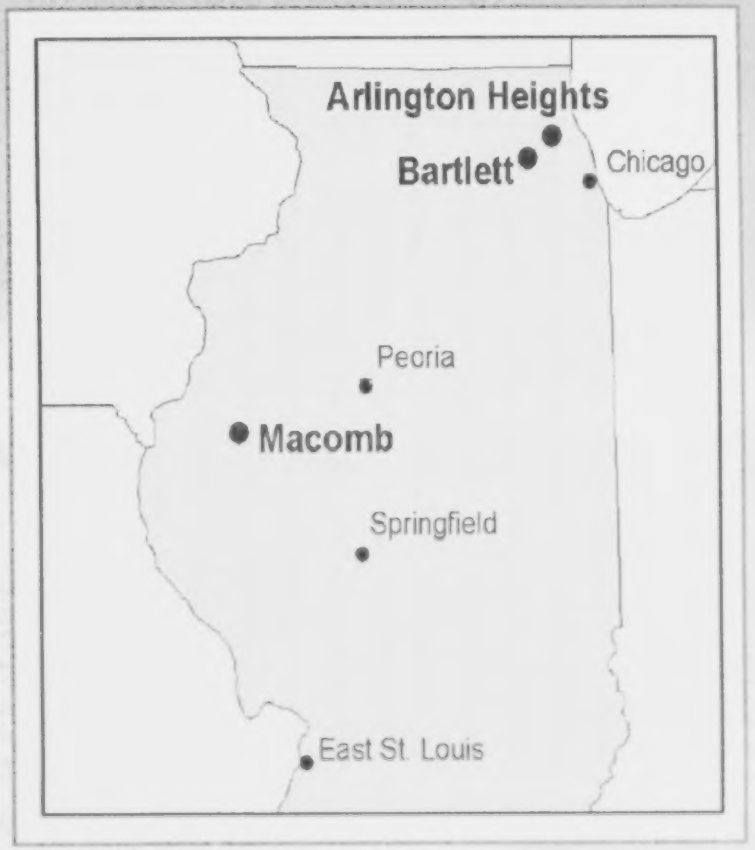
- **Population ~ 76,000**
- **Union Pacific rail line with METRA traffic and ~ 70 tpd**
- **Crossings Involved: Dunton Ave, Evergreen Ave, and Arlington Heights Rd**

Bartlett

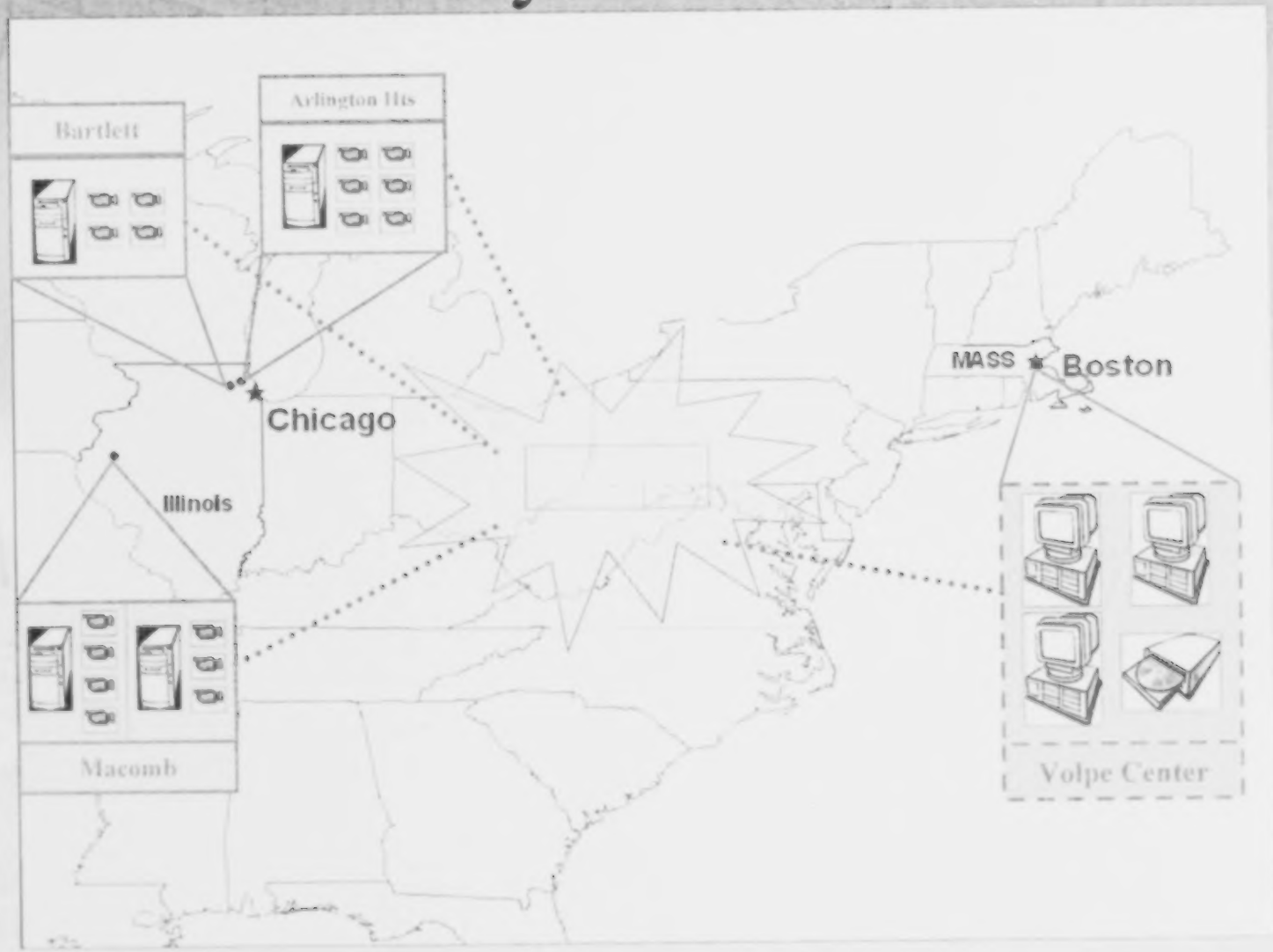
- **Population ~ 37,000**
- **METRA rail line with Union Pacific traffic and ~ 68 tpd**
- **Crossings Involved: Oak Ave and Western Ave**

Macomb

- **Population ~ 18,000 (Including ~ 10,000 Western Illinois University Students)**
- **BNSF rail line with ~ 20 tpd**
- **Crossings Involved: Jackson St, Ward St, and Lafayette St (*McArthur St*)**



Overall System Schematic



Data Viewing Efforts

- One calendar day of train events takes approximately 8 work hours to view and record associated information
- Volpe's efforts: 200 hours per week
- Recently efforts have been concentrated on one community, Arlington Heights, to produce more timely results
- To date approximately 8 months of test case data have been collected for Arlington Heights

Driver & Pedestrian Violation Types

- Type I Violation – **warning flashers are active but gates have not been activated (vertical position)**
- Type II Violation – **warning flashers are active and the gates are in motion**
- Type III Violation – **warning flashers are active and the gates are fully deployed (horizontal position)**
- Type IV Violation – **debarking passengers violate the crossing by exiting the center platform**

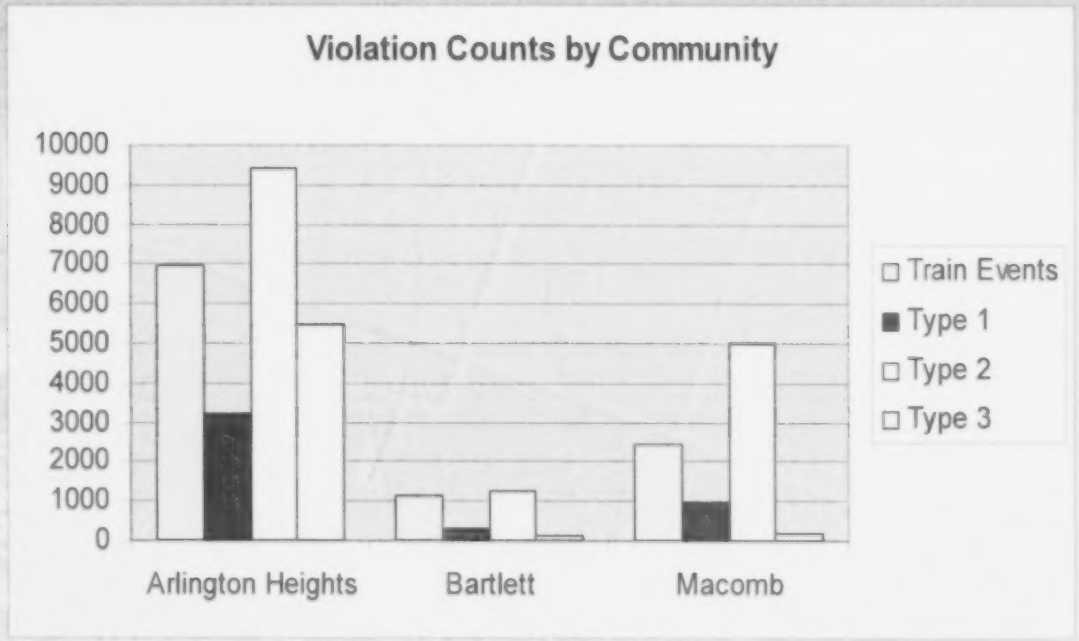
Base Case Violation Rates

- Violation rate is the number of violations/number of train events

	Arlington Heights
Type 1	0.48
Type 2	1.4
Type 3	0.78

	Bartlett
Type 1	0.24
Type 2	1.32
Type 3	0.13

	Macomb
Type 1	0.4
Type 2	2.03
Type 3	1.08



Arlington Heights Violations
Base Case vs. Test Period

	Base Case	Test Case	Reduction
Type 1	0.48	0.53	-10.4%
Type 2	1.4	1.02	27.1%
Type 3	0.78	0.41	47.4%

Arlington Heights Violations Base Case vs. Test Period

- Statistical significance at the α=0.05 level occurs when t_o>1.645
- Type 2 violations t_o=14.9∴ reduction is statistically significant
- Type 3 violations t_o=8.2∴ reduction is statistically significant

What does this mean???

It means that we can be 95% confident that the reduction in violations is NOT due to chance

Violation Rates with Police Presence

	Base Case	Police Presence	Reduction
Type 1	0.48	0.47	2.1%
Type 2	1.4	1.1	21.4%
Type 3	0.78	0.26	66.7%

- Based on police education/enforcement blitzes through December 2003
- Reduction in Type 1 violations is not statistically significant
- Reductions in Type 2 and Type 3 violations are statistically significant

Time-to-collision

- Time-to-collision is defined as the elapsed time between violation occurrence and train arrival
- Average time-to-collision for the base case was 69.9 seconds
- Average time-to-collision for the test case was 71.1 seconds

Time-to-collision (cont.)

$$H_o : \mu_b = \mu_t$$

$$H_1 : \mu_b < \mu_t$$

$$Assume \sigma_b^2 = \sigma_t^2$$

$$t_o = \frac{y_b - y_t}{S_p \sqrt{\frac{1}{n_b} + \frac{1}{n_t}}}$$

$$t_o = -1.68$$

$$t_{0.05,\infty} = -1.645$$

$t_o < t_{0.05,\infty} \therefore$ the increase in time-to-collision is statistically significant

Conclusions

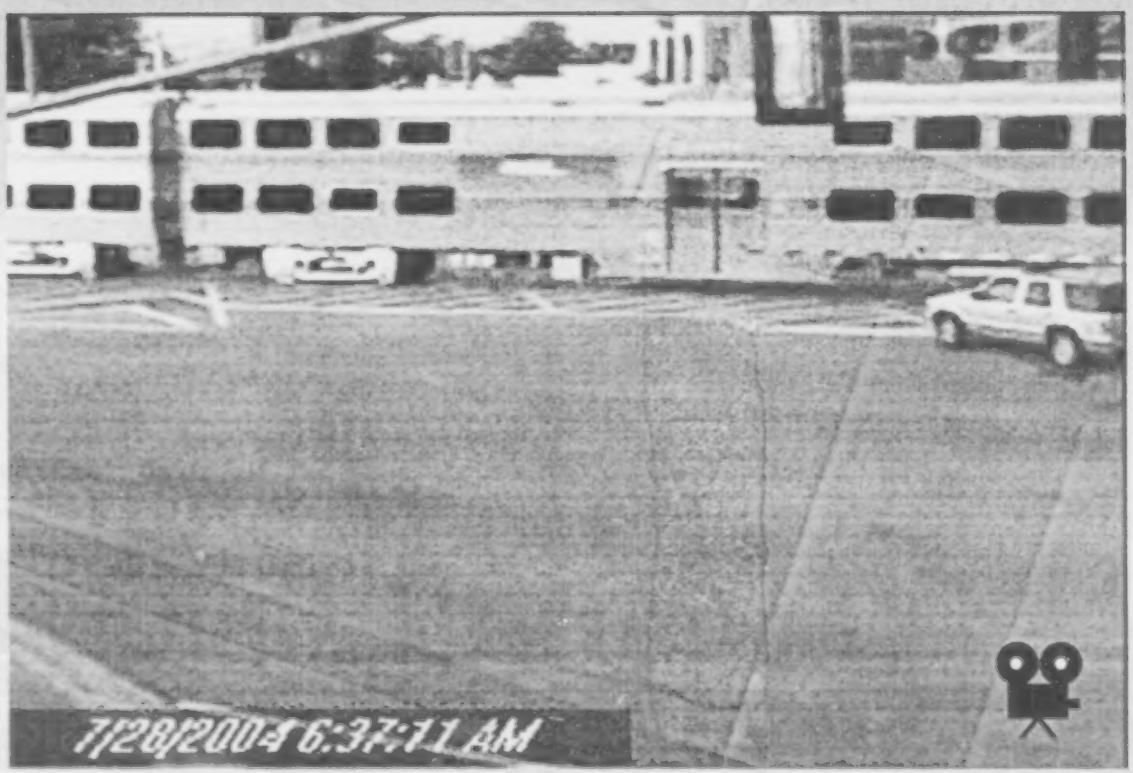
- PEERS programs in Arlington Heights are effective in reducing Type II and Type III violations at highway-rail grade crossings
- Police presence at the crossings is effective in reducing the riskier violations
- Overall, the violations committed during the test period are less risky than those committed during the base case

Sample Video Clips

Sample Video Clips

Sample Video Clips

Sample Video Clips



the VOLPE center

Thank you

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Critical Incident Stress Debriefing (CISD): Best Practices Study

Michael Coplen

Federal Railroad Administration, U.S. Department of Transportation, Washington, District of Columbia, USA

Abstract

As train suicides at grade crossings and other trespassing fatalities become of increasing concern to the railroad community, so too does the impact of traumatic exposure to locomotive engineers and train crews. In some densely populated areas it is not surprising to find locomotive engineers and train crew members who have been exposed to numerous fatalities, sometimes resulting in Post Traumatic Stress Disorder (PTSD) and its concomitant emotional and behavioral consequences, such as marital difficulties, decreases in productivity, increased absenteeism, depression and avoidance of the trauma circumstances at the workplace. While PTSD is estimated to affect 7.4% to 12.0% of the adult population and up to 45% of survivors of serious motor vehicle accidents, it is not known to what extent it affects locomotive engineers and train crews exposed to grade crossing and trespasser fatalities. Intervention programs in the railroad

industry designed to mitigate the consequences of traumatic exposures such as this are also quite varied with little evidence of efficacy. The FRA, in cooperation with labor and management stakeholders in the North American railroad industry are conducting a "best practices" study of CISD programs to help benchmark current industry practices and to identify components of those practices effective at mitigating traumatic exposure to grade crossing and trespasser incidents.

U.S. Department
of Transportation
Federal Railroad Administration

FRA Human Factors R&D Program

Critical Incident Stress Debriefing (CISD): Best Practices Study

Sixth Annual Workshop on
Highway-Railway Grade Crossing Research
November 22-23, 2004

U.S. Department of Transportation

Federal Railroad Administration

CISD Best Practices Study: Background

- 1995: Grade Crossing Research Needs Workshop
- Concern about PTSD among locomotive engineers and train crews
- Impact of traumatic exposure to grade crossing and trespasser incidents
- Multiple exposures for some individuals

U.S. Department of Transportation
Federal Railroad Administration

CISD Best Practices Study: What is PTSD?

A clinical diagnosis characterized by:

• **T**raumatic event	**T**
• Persistent **R**e-experience	**R**
• Persistent **A**voidance	**A**
• Symptoms of Aro**U**sal	**U**
• Duration is more than 1 **M**onth	**M**
• **A**nxiety distress or impairment	**A**

Studies on Impact of PTSD

Professional

- Lower levels of productivity
- Avoidance of trauma circumstances and work areas
- Increased layoffs, absenteeism, leaves of absence
- Less desire to continue working

Personal

- Increased stress
- Disproportionate use of medical/mental health care system
- Higher use of EAP programs
- Marital difficulties, financial and health problems
- Reluctance to seek treatment

U.S. Department of Transportation

Federal Railroad Administration

Estimated Prevalence of PTSD

- 7.4% – 12% of adult population
- 6.3% who experience trauma will develop PTSD
- Up to 45% of MVA survivors will develop PTSD in first 18 months
- Prevalence unknown among L.E. and train crews
- Speculation that it is higher than the general population

Current Approaches

- Debriefing strategies
  - Peer counseling
  - Informal supervisor counseling
- Automatic time off
- Resiliency training
- Referrals to EAP programs
  - EMDR
  - Cognitive behavior treatment

U.S. Department
of Transportation
**Federal Railroad
Administration**

Current Railroad Industry Practices

- Various practices
- Some peer counseling
- Some resiliency training
- Some referrals to EAP programs
- Often, no counseling
- No industry standard

U.S. Department of Transportation

Federal Railroad Administration

History of CISD Study

- July 1999: Budgeted in HF Program, Grant to University of Denver
- Late 1999: Informal Working Group formed
  - BLE, UTU, AAR, FRA R&D, FRA Office of Safety
  - Developed non-regulatory process to address issues
- 2000 – 2001: Study designed and redesigned to address industry concerns
  - Focus on grade crossing and trespasser incidents
  - Emphasis on "best practices"

U.S. Department of Transportation
Federal Railroad Administration

CISD Best Practices Study: Project Goals

- 2002: Letter to CEOs from Administrator Rutter
  - Invitation to participate in national study
  - Class I's, Class II's, Short Lines, Commuter RRs
  - Established goals of study

GOALS as revised by CISD Resource Group

1. Benchmark RR CISD programs with other industries
2. Establish extent of PTSD and ASD due to grade crossing and trespasser incidents
3. Evaluate effectiveness of RR CISD practices, not programs

U.S. Department of Transportation
Federal Railroad Administration

CISD Best Practices Study: Current Status

- 2003: Pilot Study on Amtrak
- 2003: Volpe report on "CISD Resource Group: Success Criteria"
  - Identify "tangible results" of intended long-term outcomes
- 2004: Project implementation
  - OMB Announcement and Approval
  - Finalizing data analysis plan and implementation protocol
  - Begin collecting data

Locomotive Horn Interim Final Rule

Ronald E. Ries

Crossing Safety & Trespass Prevention Division, Federal Railroad Administration,
U.S. Department of Transportation, Washington, District of Columbia, USA

Abstract

On December 18, 2003, the Federal Railroad Administration (FRA) published an interim final rule in the Federal Register that will make it mandatory for trains to provide an audible warning by sounding the locomotive horn when approaching public highway-rail grade crossings. Research has indicated that the rate of grade crossing collisions in the United States increases by 66.8% at crossings equipped with flashing lights and gates when train horns are not sounded. The rule also provides a means by which the routine sounding of train horns can be stopped through the creation of a quiet zone. Cities that desire to create a quiet zone must show, through risk-based analysis, that the additional risk caused by the cessation of the sounding of the horns does not create an unacceptable level of risk. If the risk is too high, the city must take additional steps to compensate for the safety benefits lost by silencing the train horns.

Locomotive Horn Interim Final Rule

6th Annual Workshop on Highway-Railway Grade Crossing Research

Montreal, Canada

November 22, 2004

Overview

Background:

- **Most states have laws that require trains to provide an audible warning while approaching public crossings**
- **Some states have permitted whistle bans under state law or home rule**
- **This rule is *required by statute* in order to provide a National policy for train horn use**

Overview

At a crossing with flashing lights and gates, the effect of a train horn ban is estimated to be a 66.8% increase in risk.*

*17.3% for existing no-whistle crossings in Chicago Region

Overview

The Rule:

- **Requires trains approaching public crossings to sound horn to provide warning**
- **Enables communities to establish quiet zones by reducing the risk caused by lack of horns**

Horn Use at Crossings

- Time-based pattern (15-20 secs) rather than distance-based pattern
- Not sounded more than ¼ mile from crossing
- Retained traditional pattern

Horn Volume

- Retain minimum horn volume (96 dB(A) at 100')
- Add maximum (110dB(A) at 100')
- New test protocol: 15 ft. above top of rail (vice 4 feet)
  - Accounts for "Shadow Effect"
  - May reduce horn volumes

Overall effect is a significant reduction in train horn noise in communities

To Have a Quiet Zone:

- **Must show that the lack of the horn does not pose a significant risk with respect to loss of life or serious injury**

or

- **Must implement safety measures to reduce excess risk to an acceptable level**

Types of Quiet Zones

- Pre-Rule Quiet Zones
  - Train horns silenced as of October 9, 1996 and as of December 18, 2003
  - Existing warning devices may suffice as a foundation
- New Quiet Zones
  - Quiet Zones that do not qualify as Pre-Rule Quiet Zones
  - Flashing lights and gates required at each crossing

Who may establish a quiet zone?

- A public authority with responsibility for safety and maintenance of roadway at crossing
  - Traffic control authority
  - Law enforcement authority

Risk-based Analysis

- Risk must be at the level that would be expected with the train horn sounding, or below the NSRT – a Nationwide average risk level at public gated crossings where horns are sounded
- If risk is below NSRT, a corridor may qualify as a Quiet Zone without SSMs or ASMs

Applies to both New and Pre-Rule Quiet Zones

Inventory Record

To accurately assess risk, rule requires

- **National Highway-Rail Grade Crossing Inventory record for each QZ crossing must be updated**

Determination of Risk

Risk index (RI) components for each crossing

- expected number of collisions
- probability of fatality- or injury-producing collision
- average number of fatalities/injuries which occur in such collisions
- cost to society

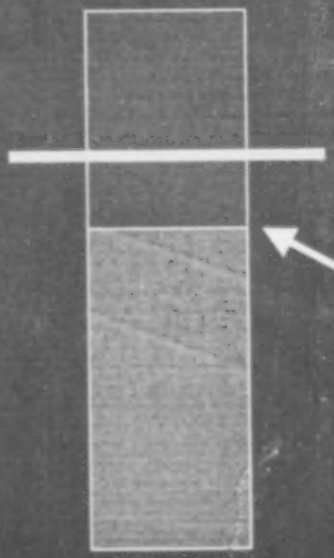
Quiet Zone Risk Index (QZRI)

Average Risk Index for all public crossings in a Quiet Zone, taking into consideration absence of train horn and presence of safety measures.

Acceptable QZ Risk

Risk w/o horn

Risk w/ horn



To create Quiet Zone:

Reduce risk to the NSRT

or

To the risk w/horn

Supplementary Safety Measures (SSMs)

- Closures
- 4 quadrant gates
- One-way street with gate across width
- Channelization arrangements with gates

Alternative Safety Measures (ASMs)

- Non-complying SSMs (e.g., shorter traffic channelization devices)
- Photo enforcement
- Programmatic education and awareness
- Programmatic enforcement

Education and enforcement ASMs must demonstrate a statistically significant improvement in effectiveness, and must be approved by the FRA.

Establishing New Quiet Zone

Public Authority Designation

Lights and Gates at every public crossing, and

- SSMs at every public crossing, or
- QZRI at or below NSRT, or
- SSMs at some crossings to bring QZRI down:
  - To or below NSRT, or
  - To or below the risk level with horns sounding

Establishing New Quiet Zone

Application to FRA

- Use ASMs to lower risk to or below NSRT or to fully compensate for the lack of train horns
- Requires FRA approval

Establishing Pre-Rule Quiet Zone

Qualified for Automatic Approval if:

- SSMs at every public crossing, or
- QZRI is below NSRT, or
- QZRI is below 2 X NSRT, and no relevant collisions in past 5 years

Must provide notification to required parties

Pre-Rule Quiet Zone

If Not Qualified for Automatic Approval

- Existing restrictions may remain for 5 years if
  - Required notifications made
  - Plans submitted to FRA within first 3 years
  - Improvements completed within 5 years
- 3 additional years if State is involved

Risk Review

- FRA may review any QZ at any time
- QZs established by comparison with NSRT will be reviewed annually (QZRI and NSRT recalculated to see whether QZ still qualifies)

Wayside Horn

- 1 for 1 replacement for train horn
- Must conform to Appendix E of rule
- Available only at gated crossings

- Rule becomes effective on 12/18/04
- For more information & research studies go to:

http://www.fra.dot.gov

and select "Train Horn Rule"

Questions???

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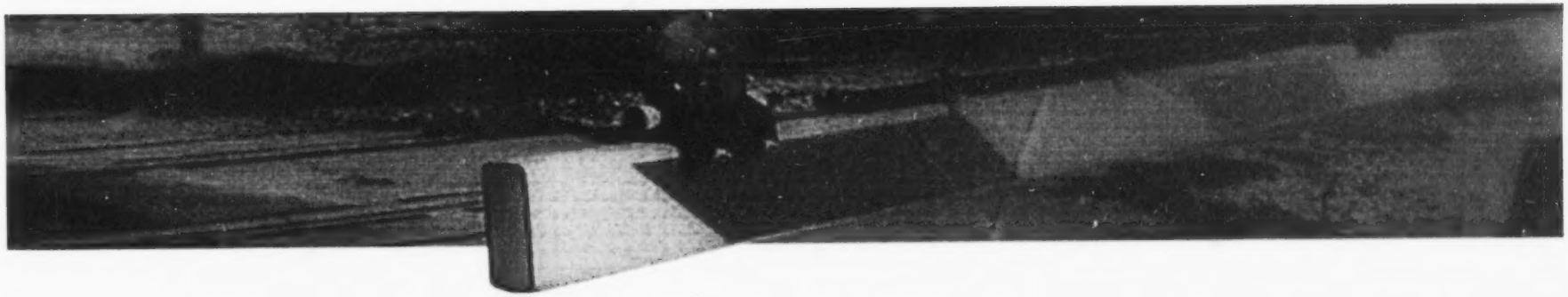


Grade Crossing Activities Update

James A. Smailes

Office of Railroad Development, Federal Railroad Administration,
U.S. Department of Transportation, Washington, District of Columbia, USA

Abstract

The FRA research program has been working to better understand the problem at grade crossings with the goal of making our research and demonstrations more effective. Since 1994, fatalities and incidents at grade crossings have declined by 47% and 41%, respectively, but this trend has reversed this year with fatalities having risen by 17% and incidents by 7% in 2004 over the same period in 2003. No specific reasons have been identified for this increase, although collisions involving semi-trailer trucks have increased over 20%.

On the technology front, reports will be published in 2005 on the Traffic Separation Study (TSS) technique developed in North Carolina to close crossings, and the evaluation of the School Street four-quadrant gate with obstruction detection system. Under the Next Generation Program, grade crossings in the Michigan high-speed corridor have been activated by the Positive Train Control (PTC)

system since January 2002. In Illinois, 69 crossings in the high-speed corridor have been equipped with four-quadrant gates with obstruction detection loops, based on the success of a similar system deployed in Connecticut on the Northeast Corridor. An updated GradeDec benefit/cost software is available on the FRA website. Finally, the FRA has joined with the North Carolina Department of Transportation and Norfolk Southern Railway to analyze the incidents recorded by their locomotive-mounted RailView video monitoring systems. The presentation concludes with updates on the funding sources available for doing research in the U.S.

U.S. Department of Transportation
Federal Railroad Administration

Grade Crossing Activities Update

Sixth Annual Workshop on Highway-Railway Grade Crossing Research

November 22, 2004

James A. Smailes, P.E.
Program Manager
Office of Railroad Development

FRA Grade Crossing Program Framework

I Understanding the Problem

II Enhanced Infrastructure and Technology

III Improving People's Behavior

IV Deployment

DOT Grade Crossing Programs and Functions

	Understand the problem	Enhance technology	Improve behavior	Deploy
FRA Office of Safety Data Collection	X			X
RDV NGHSR	X	X	X	
RDV R&D	X	X	X	
Section 1103(c)				X
FHWA Section 130				X
FHWA R&D	X	X	X	
Foreign	X	X	X	

Reductions in Fatalities/Incidents 1994 – 2003/2004

	Crossing Fatalities	Crossing Incidents	Trespass Fatalities	Trespass Incidents
1994	615	4,979	529	981
2003 final	329	2,931	502	896
Reduction	- 47%	- 41%	- 5%	- 9%
2004 thru July	+ 17.3% over '03	+ 7%	- 1.8%	- 3.7%

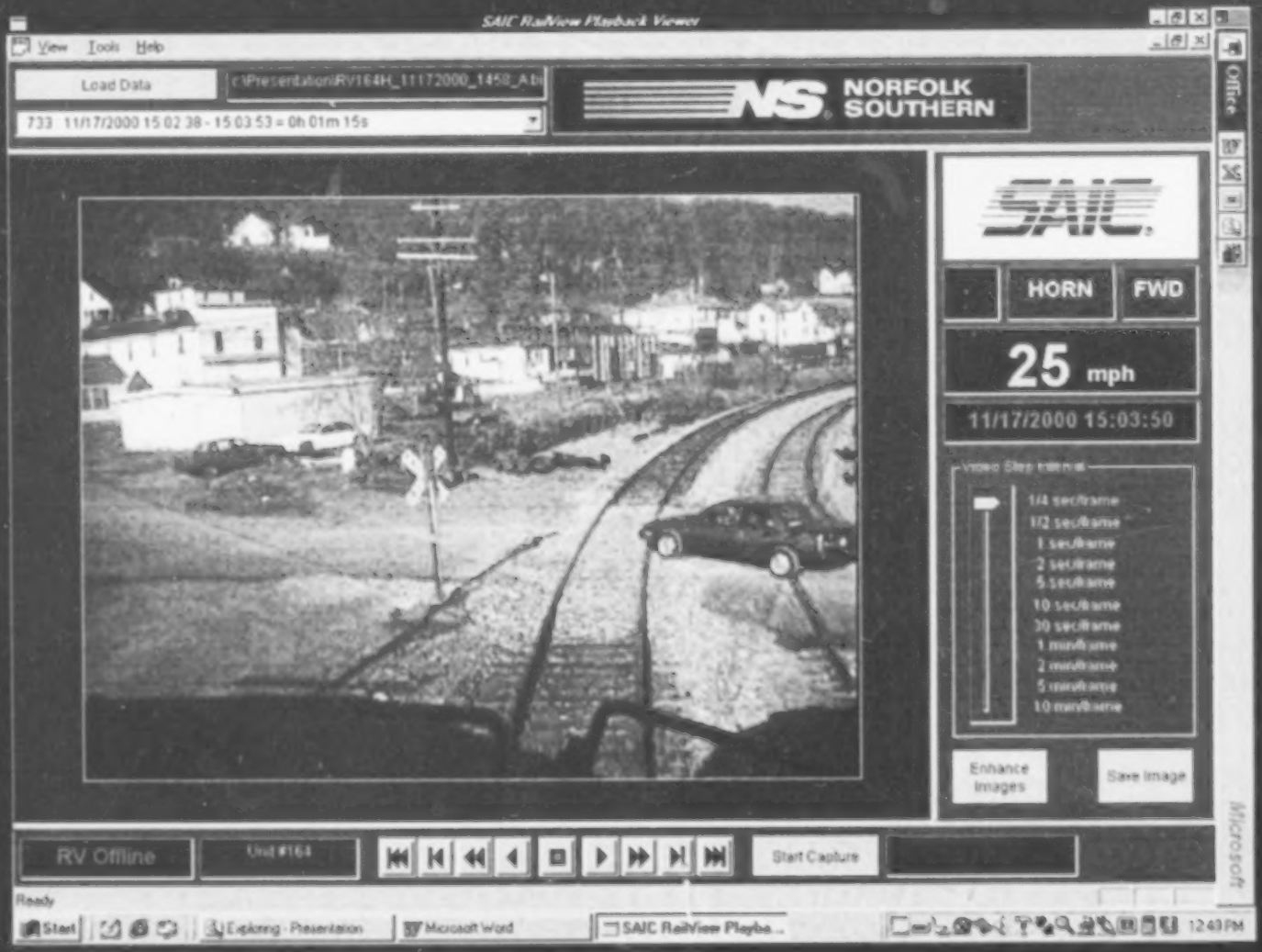
(I) Understanding the Problem

- **New sources of objective data**
  - FIi-map and RailView – FIi-map data collected for Chicago CREATE project and is now being analyzed
  - RailView grants awarded to NS and NCDOT
- **Analysis**
  - Determine risk vs. speed
  - Assess what has worked from Action Plan
  - Identify aggravating factors
- **Model, synthesize and deliver knowledge**
  - GradeDec and ASCAP

(I) FY 2005 Program

- Use RailView data to
  - evaluate crossing improvements in NC Sealed Corridor and along NS routes
  - improve Risk Assessments & identify Aggravating Factors at crossings and for trespassers
- Pursue most effective actions from analysis of the prior Action Plan results
- Complete Research Needs Proceedings
- Support activities on the Final Train Horn Rule

(I) RailView – “No whistle” ordinance area, passive crossing



(I) Foreign Projects

- Transport Canada
  - Development of overall strategic plan for rail research, including grade crossings
- United Kingdom Rail Safety and Standards Board (RSSB)
  - CCTV for security
  - Estimating railway risks at a network level
  - Modeling the economics of level crossing closures and conversions

(II) Enhanced Infrastructure and Technology

- Methods to eliminate crossings wherever possible
- Low-cost, effective warning/protection systems (NC Sealed Corridor – 5+ lives have been saved so far)
- ITCS – advance activation of crossings
- NAJPTC 69 crossings - 4-quad w/ obstruction detection

(II) FY 2005 Program

- Develop Closure/Eliminations Guidelines
- 4-quad gate evaluation NAJPTC
- Obstacle/Intrusion detection update
- Wheeled Access Flangeway gap synthesis
- ITS portable traffic control device with University of Nebraska

(III) Improving People's Behavior

- Driver Behavior, Accident Causation
  - Additional $500k added to R&D for accident causation/driver behavior research
- Illinois Public Education and Enforcement Research Study (PEERS)

(III) Improving People's Behavior FY 2005

Ongoing Projects

- Driver behavior
- Causal analysis
- Optimal acoustic warnings

New Projects

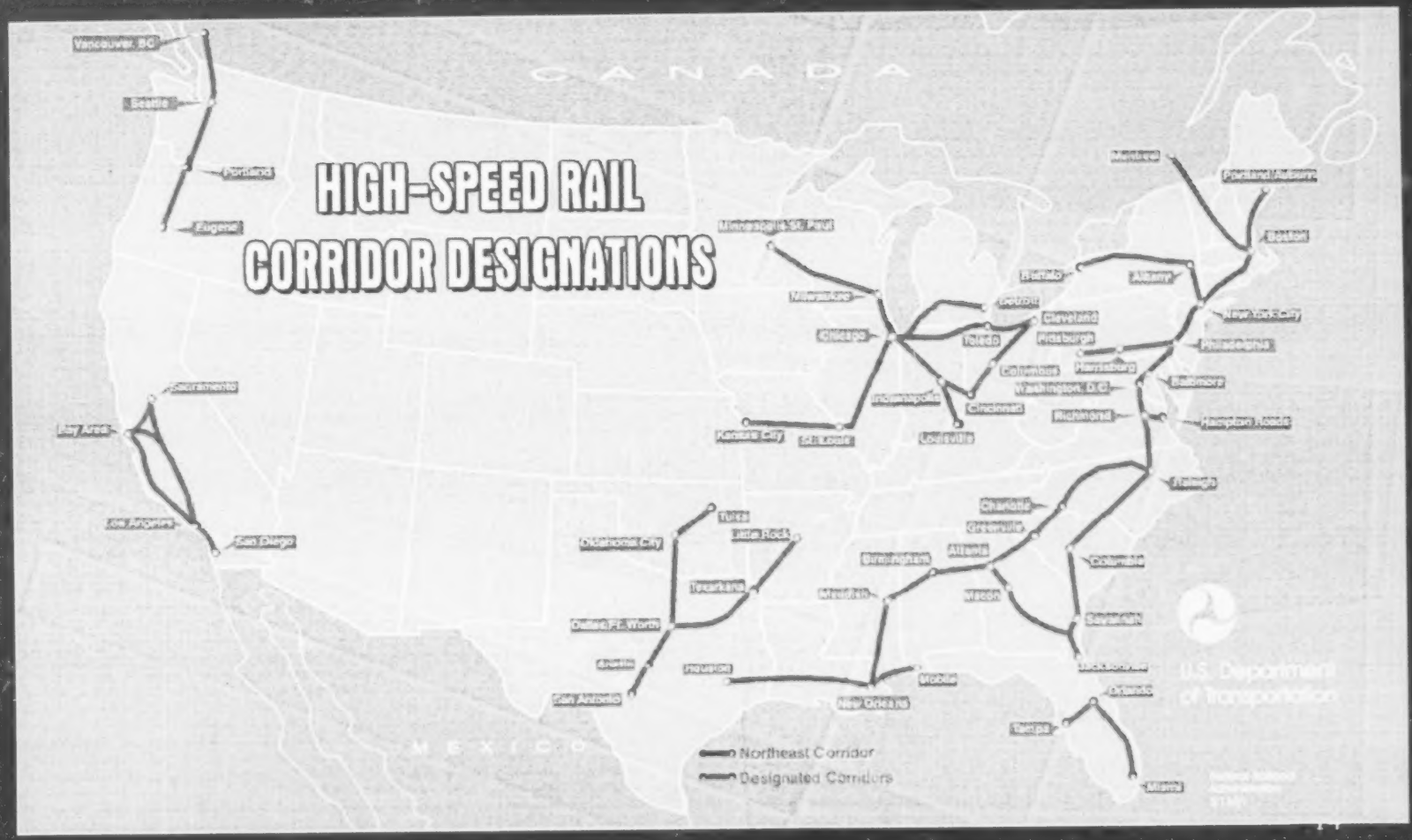
- Commuter crossings
- Trespassers

(IV) Deployment

- Operation Lifesaver (FRA/FHWA support)
- Train Horn Rule Implementation
- Section 1103(c) - $5.25M/yr
- FHWA Section 130 - $150M/yr – *possibly not reauthorized in the new bill*

Designated High-Speed Corridors

Section 1103(c)



(IV) Effectiveness of the Section 1103 (c) Program

$ in millions, 1993 - 2004

- More than 320 grade crossings improved
- 116 crossings closed
- 13 grade separations built, 4 under construction

Section 1103(c)	Other Federal	State	Railroad + Other	Total
65.6	90.4	63.3	10.2	229.5

RDV FY 2005 Request

as modified by House and Senate Reports

- **R&D Grade Crossings** **$2.535 million**
  - Infrastructure ($600k)
  - Human Factors ($1,935k)

  House Report added $500k for human factors research
- **NextGen Grade Crossings & Innovative Technologies** **$4.35 million**

Section 1103(c) **$5.25 million**

Total **$12.135 million**

FY 2006 Potential

- Implement criteria to close crossings and take other actions proven successful from the Action Plan analysis
- Continue with RailView data analysis to improve treatments to reduce grade crossing and trespass incidents
- Risk assessment and ASCAP
- Continue equipment demonstrations including ITS/PTC

Day 1 Closing Comments

Daniel Lafontaine
Rail Safety Directorate, Transport Canada, Ottawa, Ontario, Canada

Thank you for coming to the 2004 Workshop on Highway-Railway Grade Crossing Research. The room is still full, which is an indication of this year's success and the quality of the presentations.

If we go back to the beginning of the Grade Crossing Research Program, the railway companies were front and foremost full participants. It is very encouraging that, of eight provinces with a significant railway network, six have now participated in different projects, both financially and through steering committees.

Representation from the municipal world is also starting: the City of Ottawa was the pioneer last year in expressing some of the needs it would like to be addressed in grade crossing safety, and this year the City of Calgary made an excellent presentation on the use of ITS technology to relieve traffic congestion caused by trains travelling over a grade crossing. This shows that grade

crossing safety sometimes goes way beyond the grade crossing.

Partnership is key in grade crossing safety. The partnerships in this program extend beyond the day-to-day operations between the highway and railway communities.

Today, we heard Aidan Nelson from the UK and his interest in sharing information. I believe that we would all gain in a research partnership agreement with the UK.

Gord English talked to us about the challenge of using automated enforcement. An important issue is the different levels of jurisdiction in grade crossing safety — provincial and federal, different provincial Highway Traffic Acts. D2006 may want to approach this problem.

Alison Smiley introduced a very promising project on visual behaviour and conspicuity/effectiveness of grade crossing elements. It will generate interesting results and make for an excellent presentation next year.

I would like to thank Dave Green and Frank Saccomanno for very good presentations, and acknowledge our friends from the US who have been participating in our workshop since the beginning. Today we heard from Suzanne Sposato from the Volpe National Transportation Systems Center, Michael Coplen and Ron Ries of the FRA, and

James Smailes of the FHWA. Some of the clips shown by Suzanne may have been amusing, but it is very scary to see some of the behaviour at grade crossings, not to mention the dangerous actions that we don't know about.

I would also like to extend a sincere "thank you" to you all for participating in the roundtable discussions, and to our facilitators, Peter, François, Frank and Martin. Their role is very important, as the information exchanged during those sessions is key in the program development.

Finally, a big thank you goes to the Transportation Development Centre and its team for organizing this great workshop — Barbara, Luc, Anthony, Paul and Sesto, thank you all!

Understanding Train Suicides

Brian L. Mishara

Centre for Research and Intervention on Suicide and Euthanasia (CRISE), Université du Québec à Montréal, Montréal, Quebec, Canada

Abstract

Train suicides are present in countries around the world and have been particularly frequent following media presentations and publicity of this method of suicide. After a brief presentation of the suicidology field's understanding of how individuals choose a particular method to end their lives, we discuss the specific method of choosing to kill oneself by being hit by a train. The issue of substitution of methods is also addressed. In addition, the particular case of increases in train suicides in Germany after a fictional television program about a suicide using this method is discussed, as well as several studies of motivations for suicide and risk factors in subway-metro systems. Discussion focusses on potential programs to prevent suicides using this method and research needs in this area.

Understanding Train Suicides

Brian L. Mishara, Ph.D., Director

Centre for Research and Intervention on Suicide and Euthanaisia

Centre de recherche et d'intervention sur le suicide et l'euthanasie

Professeur, Département de psychologie

IRSC CIHR

UQÀM
Université du Québec à Montréal

Fonds de recherche
sur la société
et la culture
Québec

Plan

I) Some basic information on suicide and train suicides

II) Short course on understaning suicide in general and how to prevent suicide (10 minutes)

III) Where train suicides fit in the picture

IV) Suggestions from experiences with other means of suicide

V) What we need to know

Some basic information on suicide

- Suicide exists in every country in the world and there have always been suicides everywhere
- Humans are the only species to commit suicide
- People who kill themselves almost always have serious mental health or abuse problems (alcohol, drugs)
- BUT, takes more than the above to commit suicide – most people with serious problems never become seriously suicidal
- Most seriously suicidal people never kill themselves, they get help and change their minds (prevention generally works)
- No matter how « serious » people are, they are usually happy to be saved
- As we shall see later: if « acceptable » means are not available, the risk is greatly diminished
- Media reports on suicides, no matter how well intentioned, increase the risk of « copy cat » deaths in vulnerable people who are already suicidal

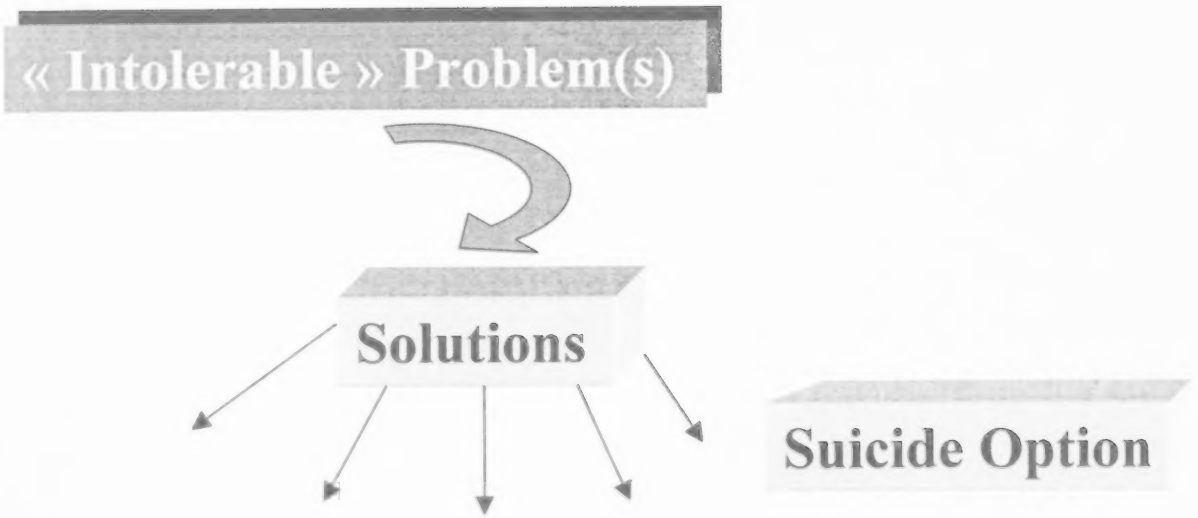
Some basic information on train suicides

- The accident - suicide blur: reliable data are lacking
- Not so in Germany,
  - 75% of unnatural deaths that involve trains are suicides, 10% survival rate, is major method for men
  - Germany: 1997-2002 N=5,731 deaths (18/week) (37,080 km system)
  - 16 high risk places (75% near psychiatric hospitals)
  - their horrible media experience

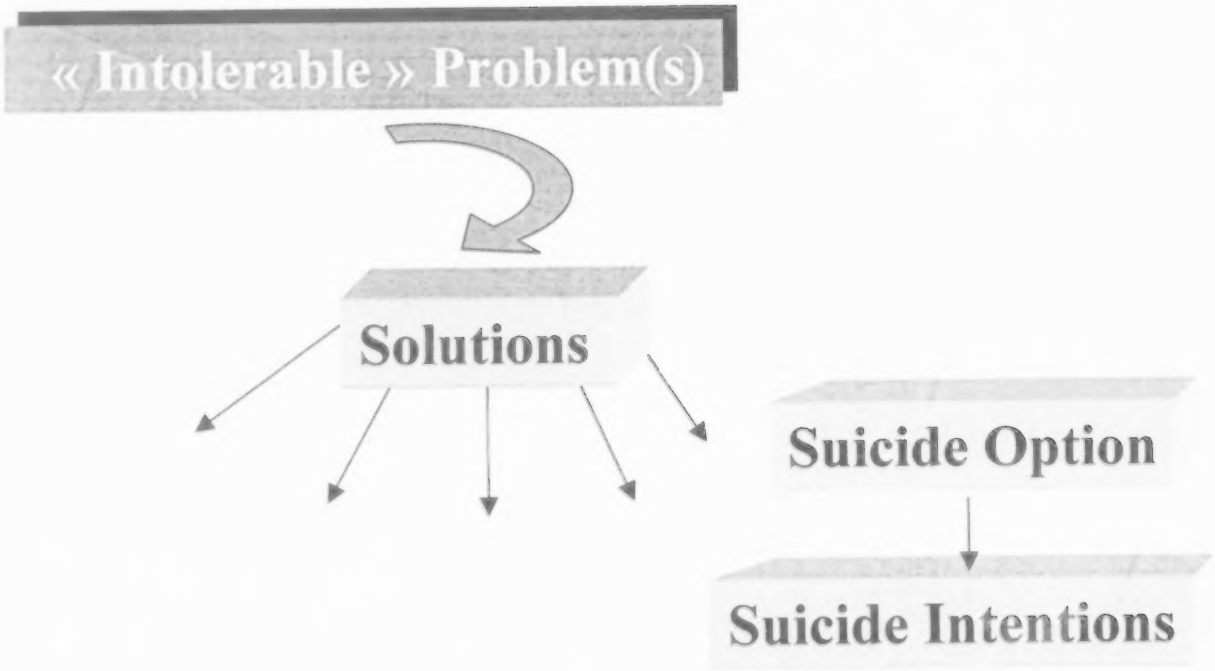
Some basic information on train suicides

- We know more about Metro – Subway Suicides
  - Montreal study 1986-1996
    - 129 Metro suicides
    - 105 of which had serious mental health problems
    - 81% expressed their suicidal intentions
    - 66% previously attempted suicide
    - 9% attempted in the Metro
    - 73% had inpatient psychiatric treatment
    - 27% resided in Mental Health facilities when they died
  - In Montreal there have been attempt clusters after media reports

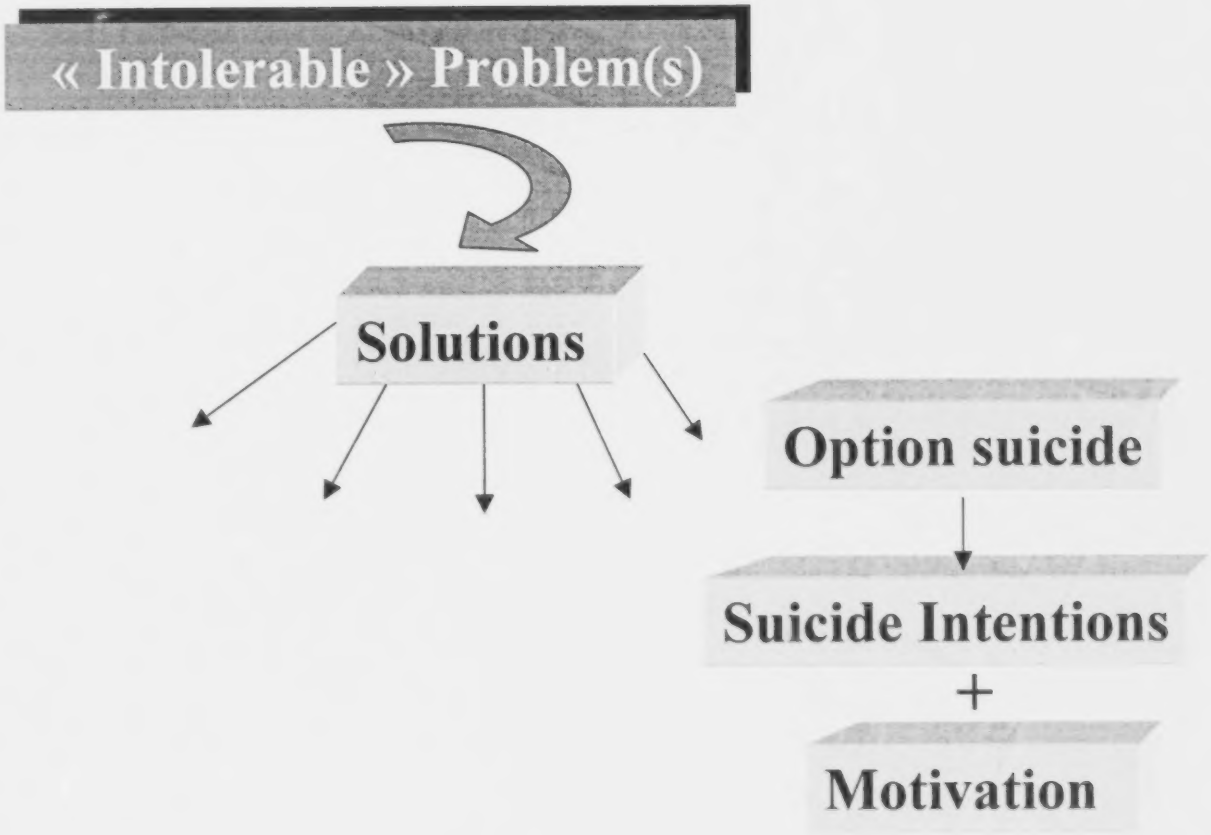
Understanding Suicide and Suicide Prevention



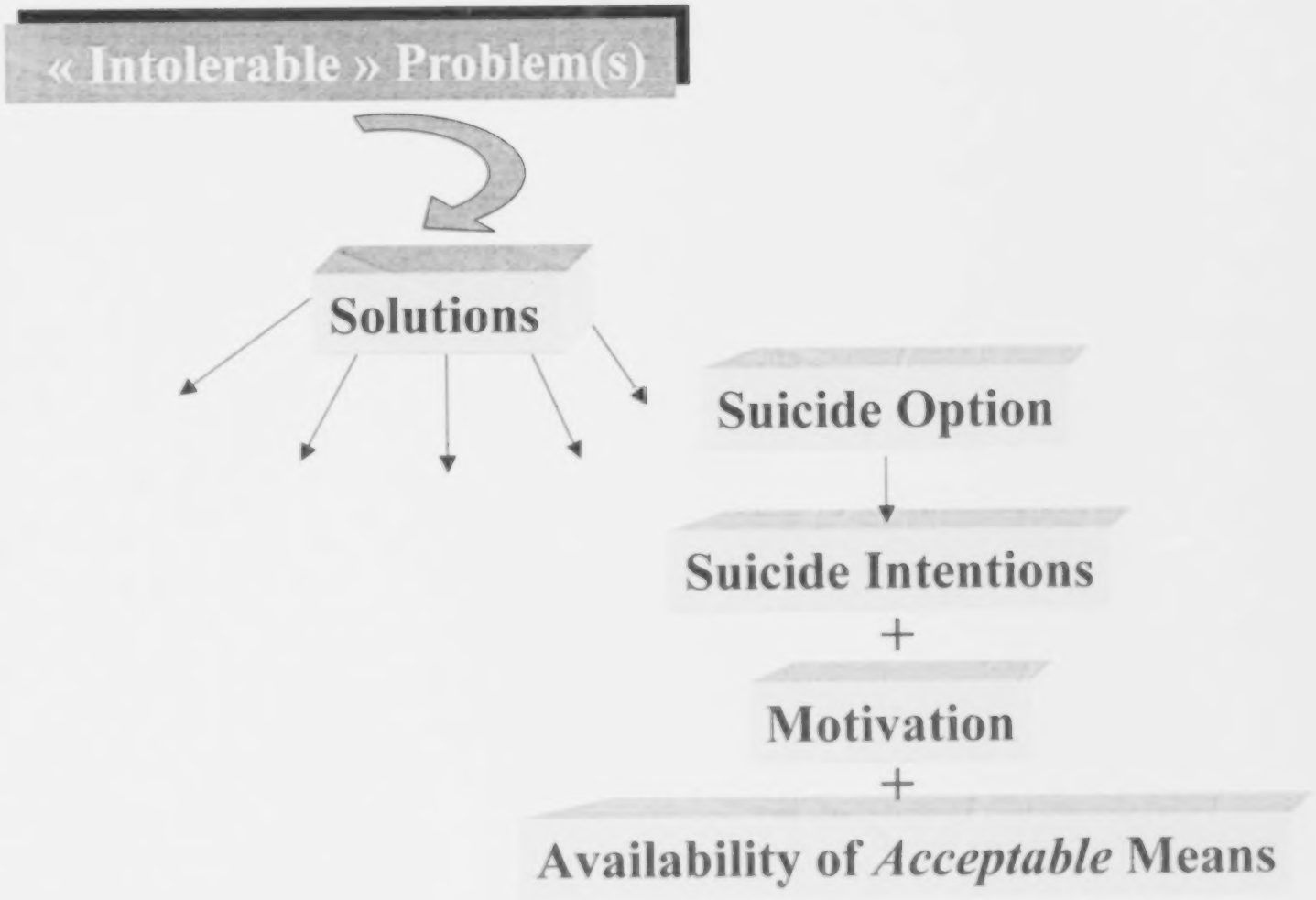
I could solve my problems – stop suffering – if I kill myself

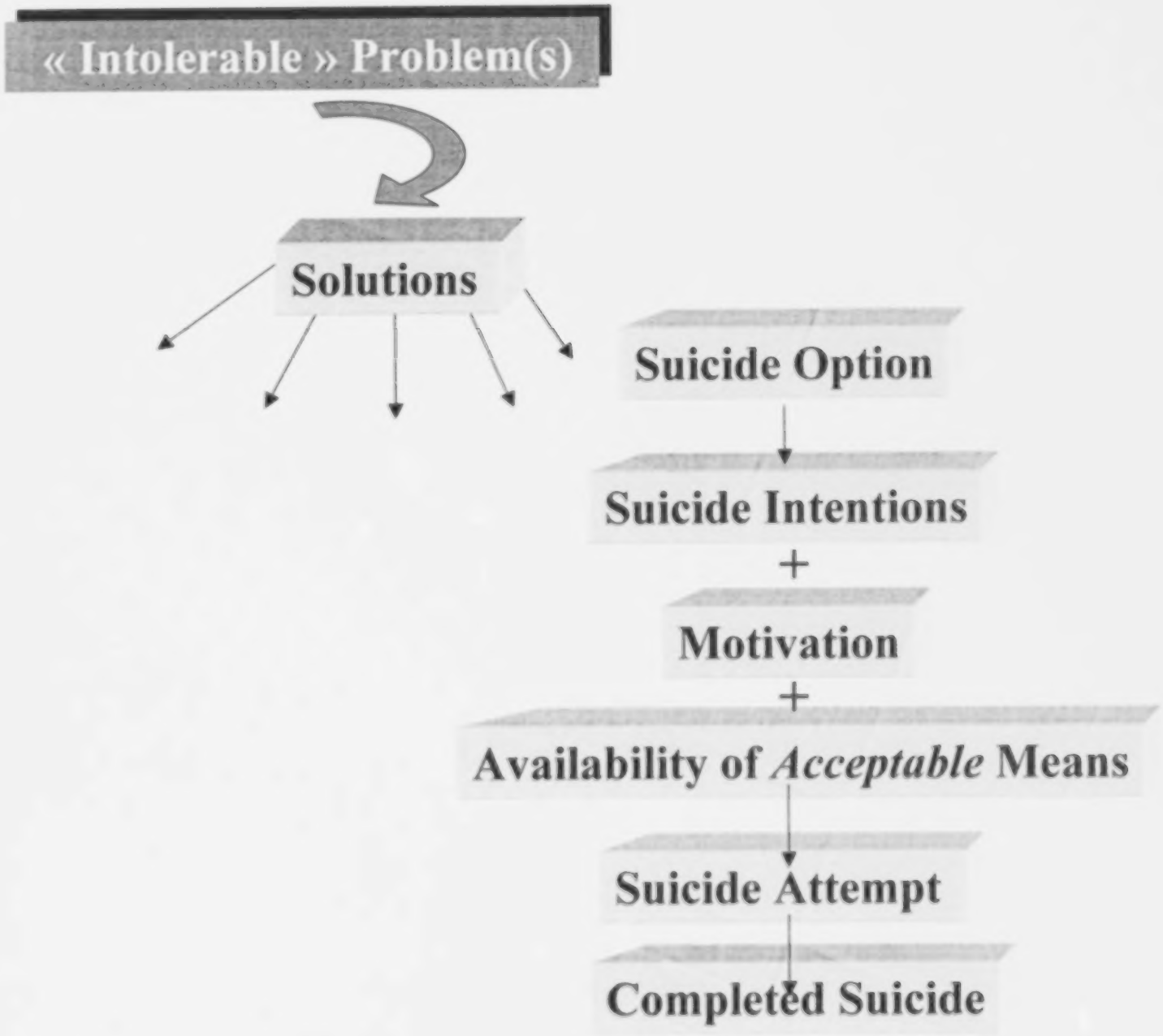


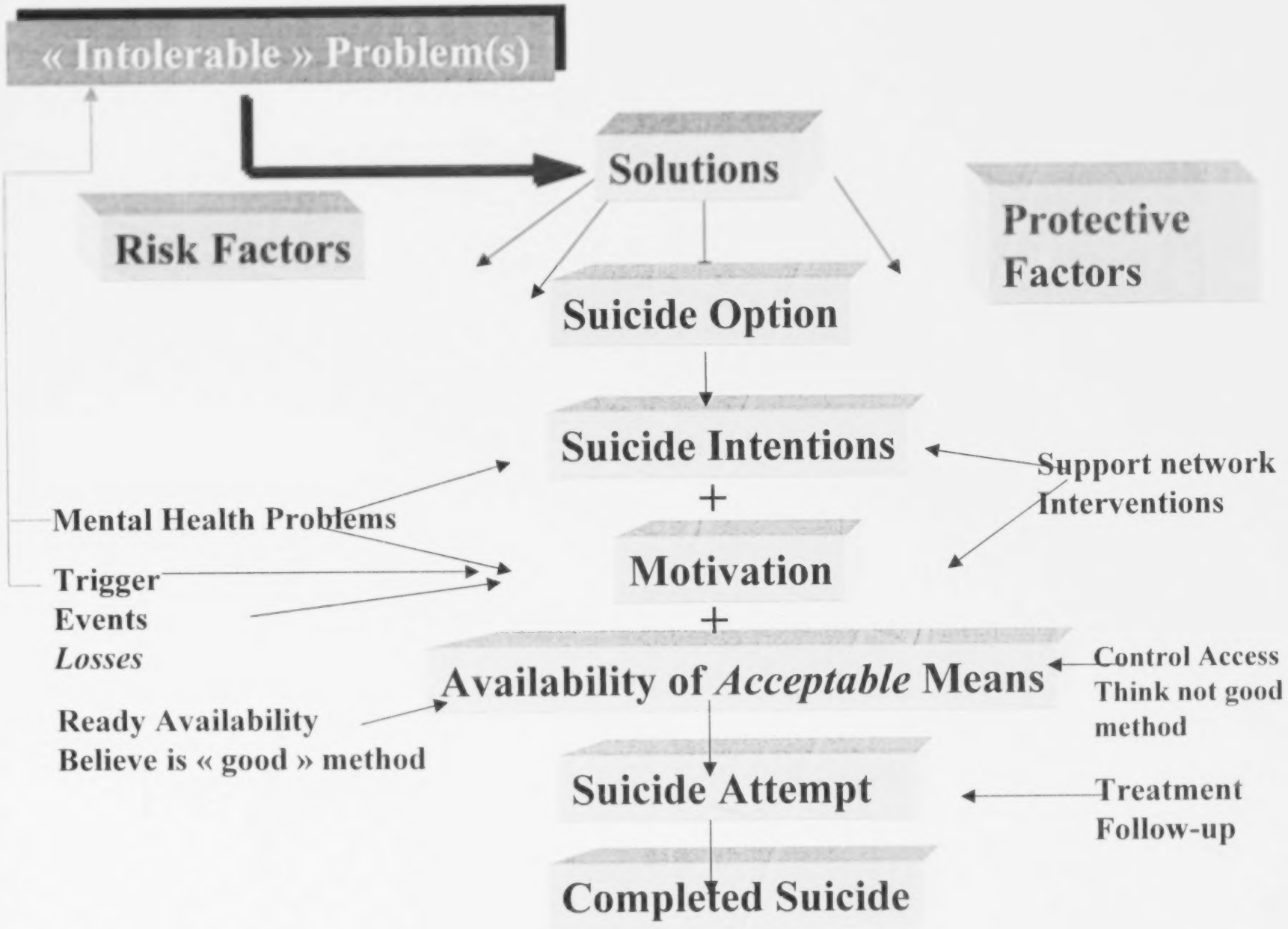
I want to kill myself



I am going to kill myself


« Intolerable » Problem(s)
Solutions
Suicide Option
Suicide Intentions
+
Motivation
+
Availability of *Acceptable* Means
(+ Trigger event) and an attempt may occur


« Intolerable » Problem(s)
Solutions
Suicide Option
Suicide Intentions
+
Motivation
+
Availability of *Acceptable* Means
Suicide Attempt
Completed Suicide


« Intolerable » Problem(s)
Solutions
Risk Factors
Protective Factors
Suicide Option
Suicide Intentions
+
Motivation
+
Availability of *Acceptable* Means
Suicide Attempt
Completed Suicide
Support network
Interventions
Mental Health Problems
Trigger Events
Losses
Ready Availability
Believe is « good » method
Control Access
Think not good method
Treatment
Follow-up

Where train suicides fit in the picture

- People choose methods which
  - Are readily available
  - They think are « good » methods
  - They learn that others use (from media or conversations)
  - Are the « in » methods
  - They think they will certainly die, they will die quickly and painlessly

Where train suicides fit in the picture

- Attempters often tell others about their plans or give identifiable signs
  - May be seen as a « cry for help »
  - Threats are often ignored or not taken seriously
- When an attempt is imminent, people often do not proceed with their plans when
  - Help is offered (e.g. posters & phones near bridges)
  - It is difficult to access the means
  - They have to wait

Suggestions from experiences with other means of suicide

- Physical barriers work (but are often costly)
- Less publicity is directly related to fewer suicides
- Better screening and psychiatric treatment in hospitals near dangerous sites may reduce attempts
- Beliefs about the means matter a lot
- Making help available at sites can prevent suicides (e.g. poster, phones) – focus on despair
- Make sure that the German TV experience is not repeated here

What we need to know

- More about who, where, when
- Motivations and beliefs of attempters
- Protocols in mental health facilities that have multiple train suicide deaths
- Effects of specific interventions (pilot studies)

Understanding Train Suicides

Brian L. Mishara, Ph.D., Director

Centre de recherche et d'intervention sur le suicide et l'euthanasie

Professeur, département de psychologie

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Fonds de recherche sur la société et la culture
Québec

Finding HRI Hot Spots: Issues and Practical Implications

Liping Fu

Department of Civil Engineering, University of Waterloo, Waterloo, Ontario, Canada

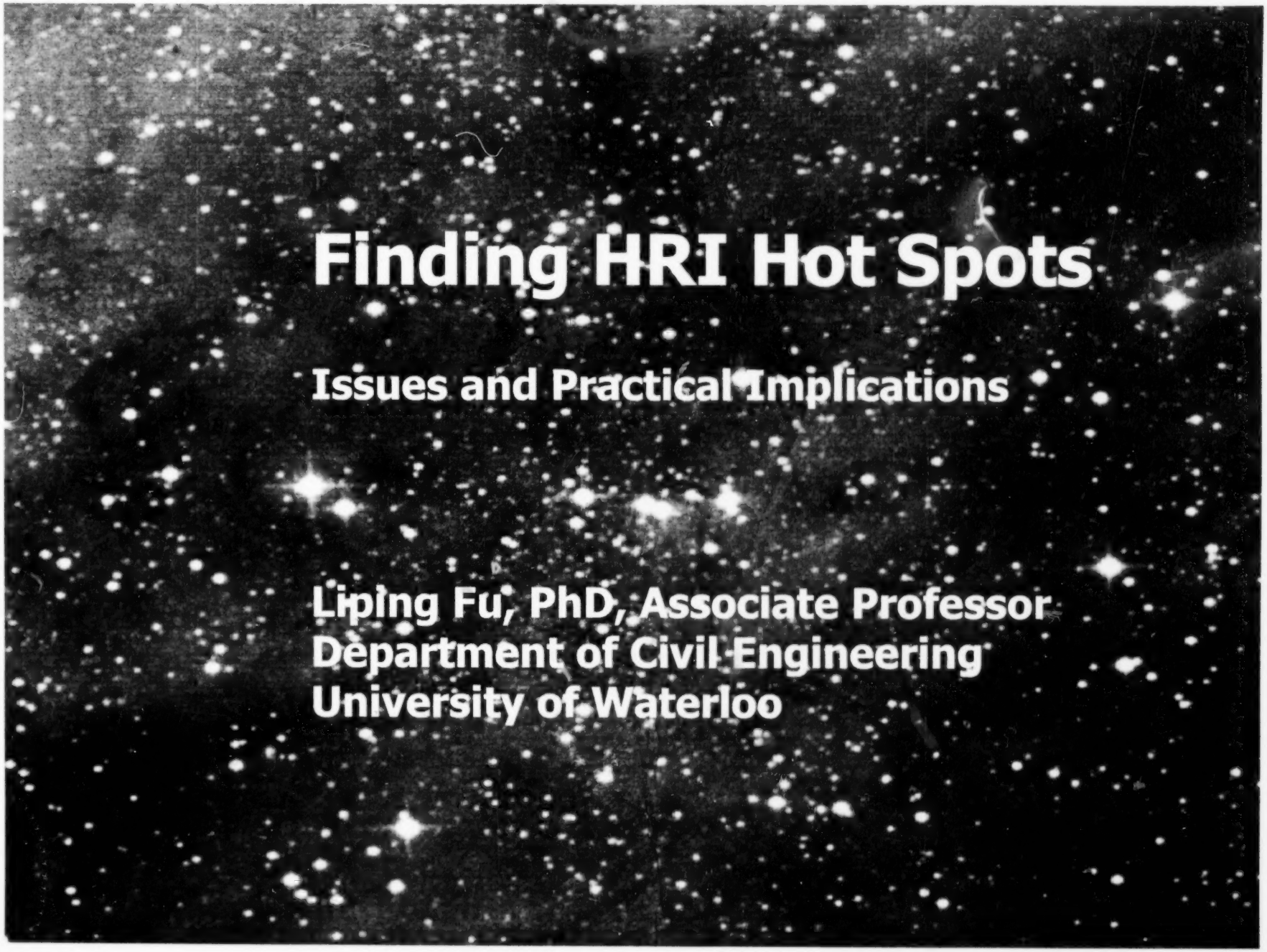
Abstract

The very first step in a safety improvement program targeted at highway-railway grade crossings is evaluating the safety status (or risk) of each crossing and identifying those crossings that show evidence of high collision risk and thus should be considered as candidate locations for remedial actions. Many different methodologies have been proposed in the past for estimating risk at grade crossings, differing in modelling philosophy (e.g. data only, model only vs. Bayesian), modelling assumptions (e.g. Poisson models vs. Negative Binomial models), level of spatial aggregation (nationwide vs. regional), and use of historical data (short term vs. long term). Few systematic efforts have, however, been devoted to investigating the differences among these approaches and their practical implications in terms of black spot identification. Many important questions still remain:

- What is the best model for estimating risk at grade crossings?

- How big is the problem to rank grade crossings based on experience (collision history)?
- Should a province use its own region-specific model or a common nationwide model?
- How many years of data should we use in risk modelling and estimation?

The primary goal of this presentation is to demonstrate that these issues are not just of theoretical importance but also of practical significance. The discussion is supported by results of our latest research efforts on grade crossing risk analysis.


Finding HRI Hot Spots
Issues and Practical Implications
Liping Fu, PhD, Associate Professor
Department of Civil Engineering
University of Waterloo

Direction 2006 Program Project:

"Identifying Highway-Rail Grade Crossing Black Spots (Phase I)"

Remaining Issues on

- Different risk estimation approaches?
- Geographical scale?
- Temporal scale?
- A few others…

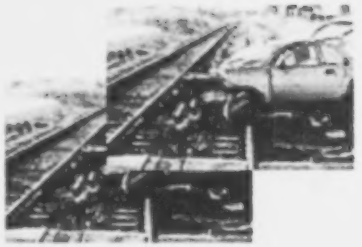
What is a Hot Spot?

- A **Hot Spot** is a grade crossing where the **risk** of vehicle-train collision is so high that safety improvement actions are warranted.

- **Risk** = the ***expected*** number of collisions and/or the ***expected*** consequences.

- But, how can we obtain the ***expected*** value?

Common Engineering Approach



$\mu = \sum x_i / n$

Expected collision rate?

Collision history?

Sample mean?

Issue I:

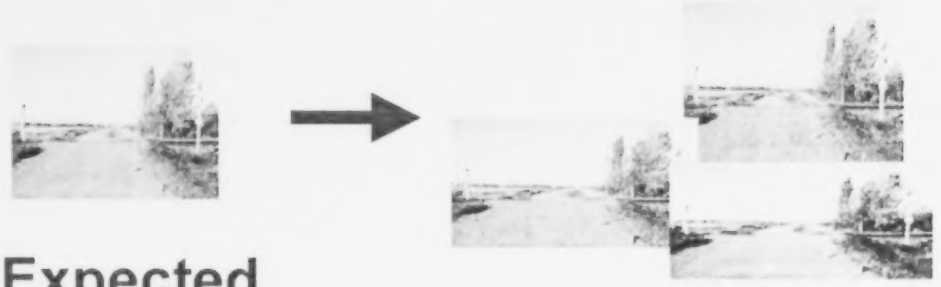
Estimating the Risk Based on Observations is Unreliable

How many years of data do we need in order to obtain an estimate of the expected collision rate of an average crossing in Canada with a maximum error of 10%?

- ~10 years
- ~100 years
- √ ~ 300 years
- ~ 500 years

Group Averaging - A Model Based Approach

Find a group of similar crossings



Use the collision history of the whole group to obtain an estimate

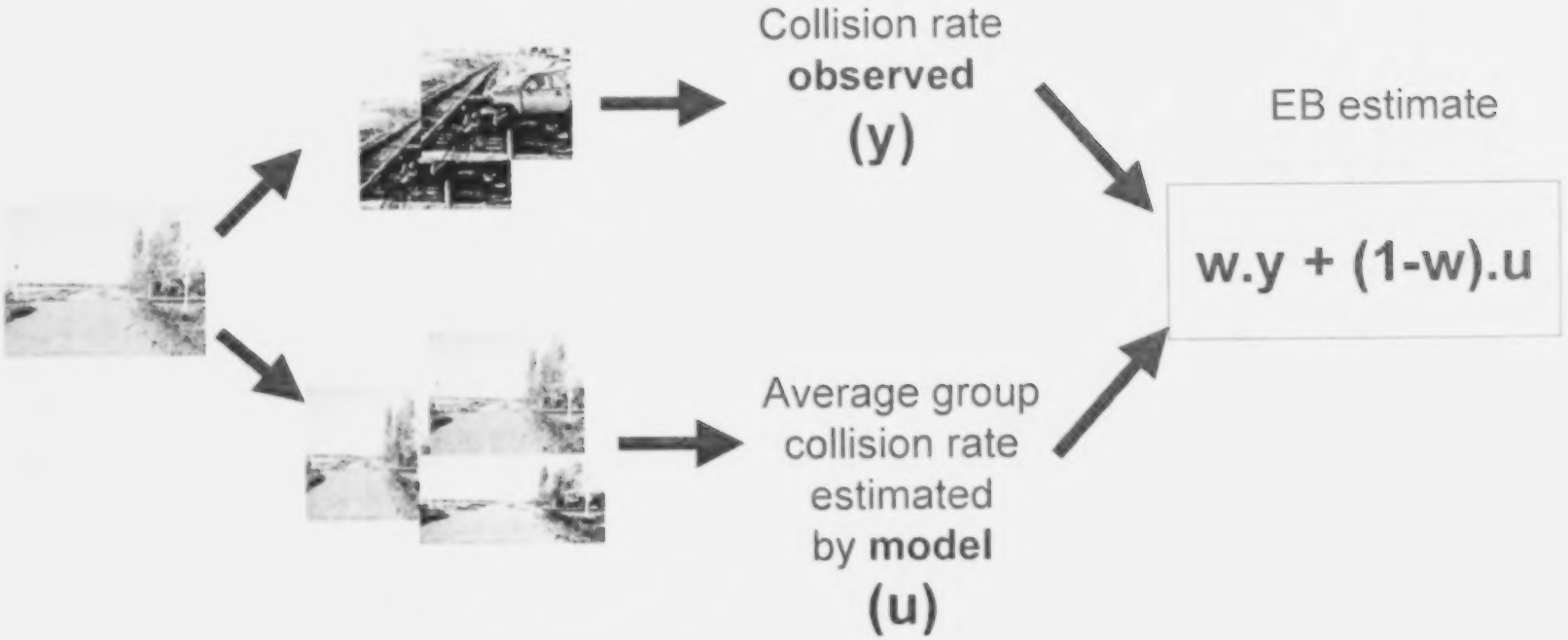
Expected collision rate?

Issue II:
Grouping (modeling) is Hard

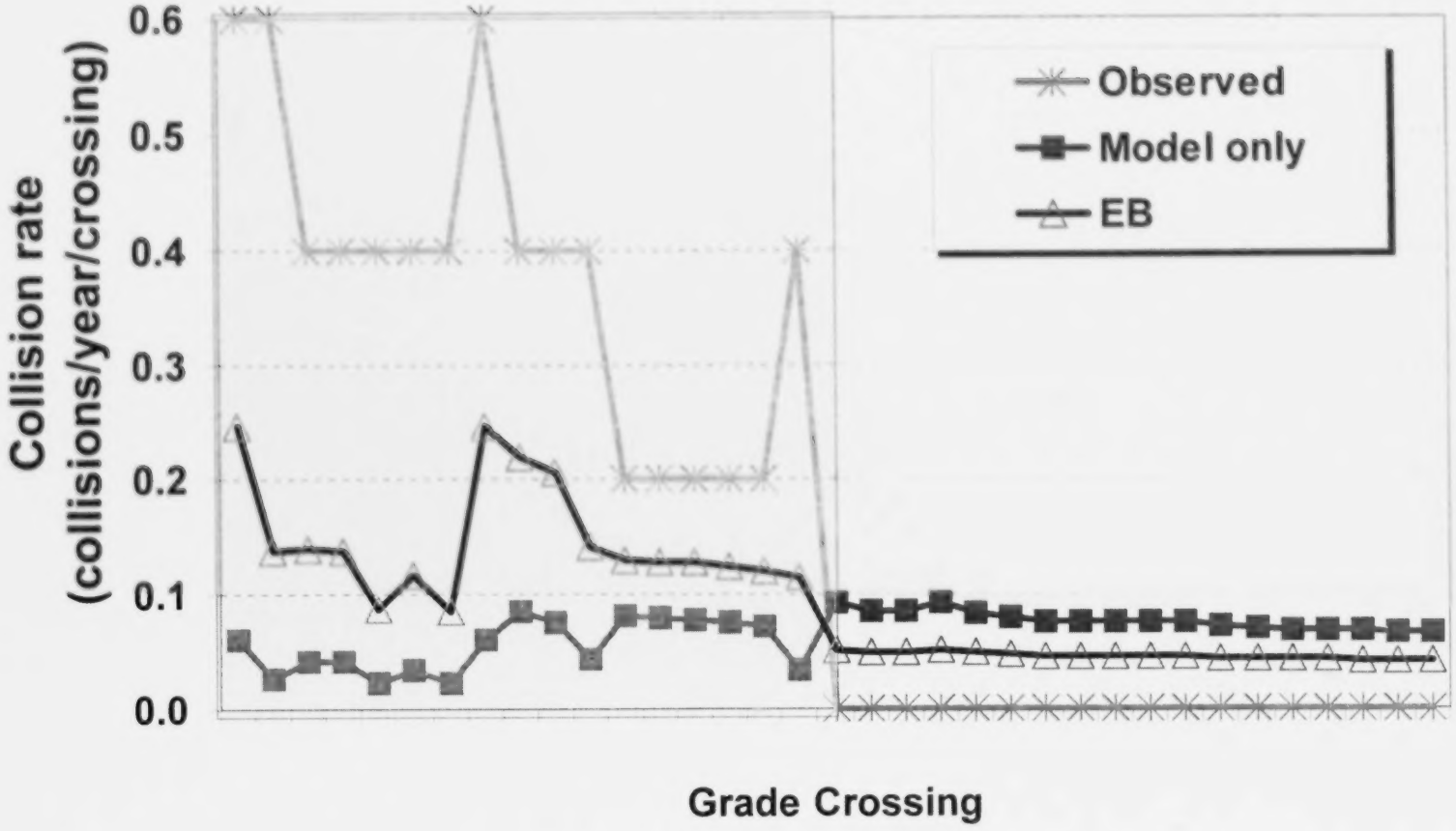
- Ideally, crossings in the same group should have the exact **same properties** AND a **large group** is needed!

- In reality, it is impossible to consider all crossing attributes in grouping, because
  - Information may not be available
  - Group size may be too small

Combining Obs. with Model - Empirical Bayesian (EB)

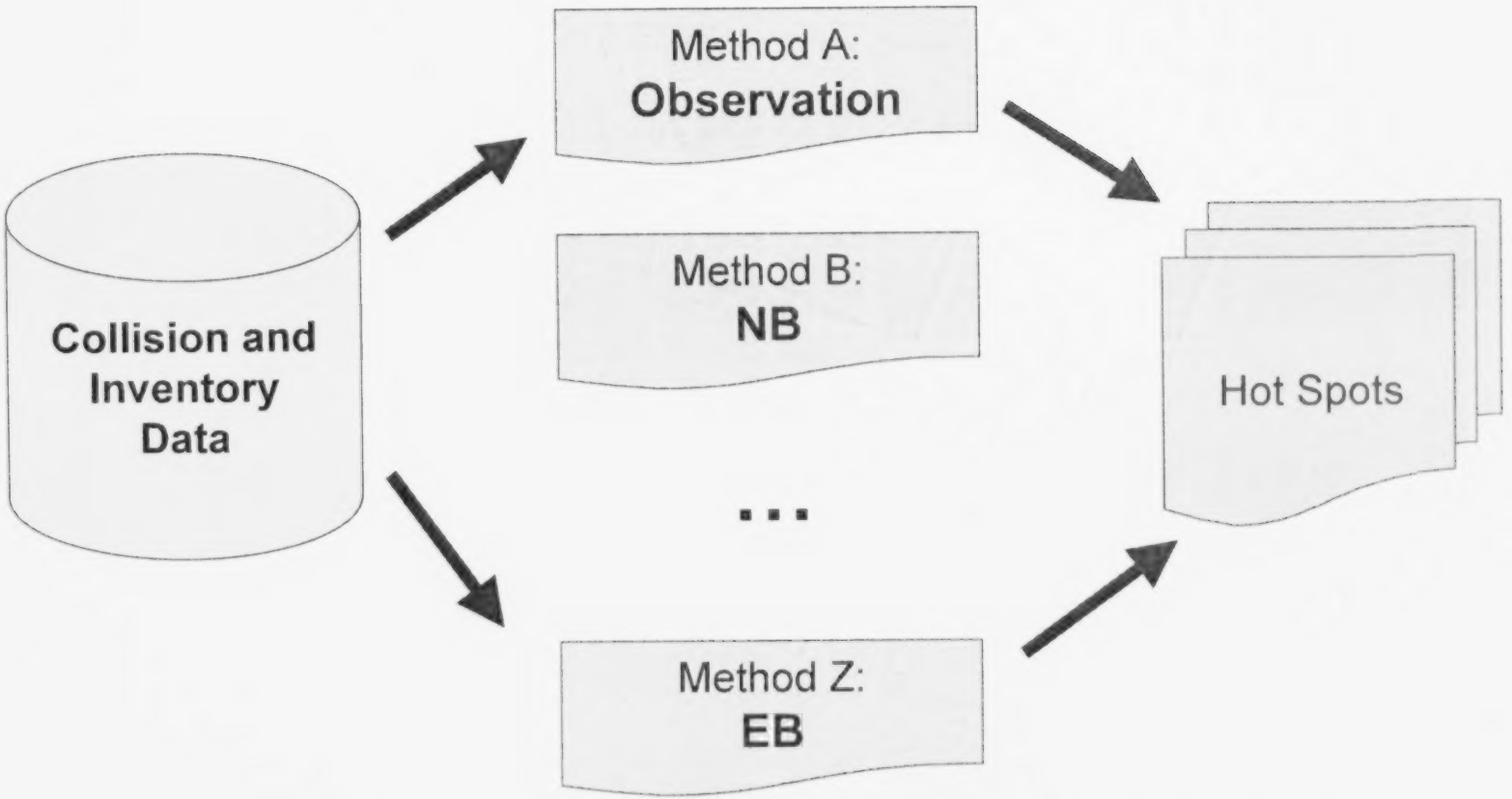


Collision Rates by Observation, Model & EB



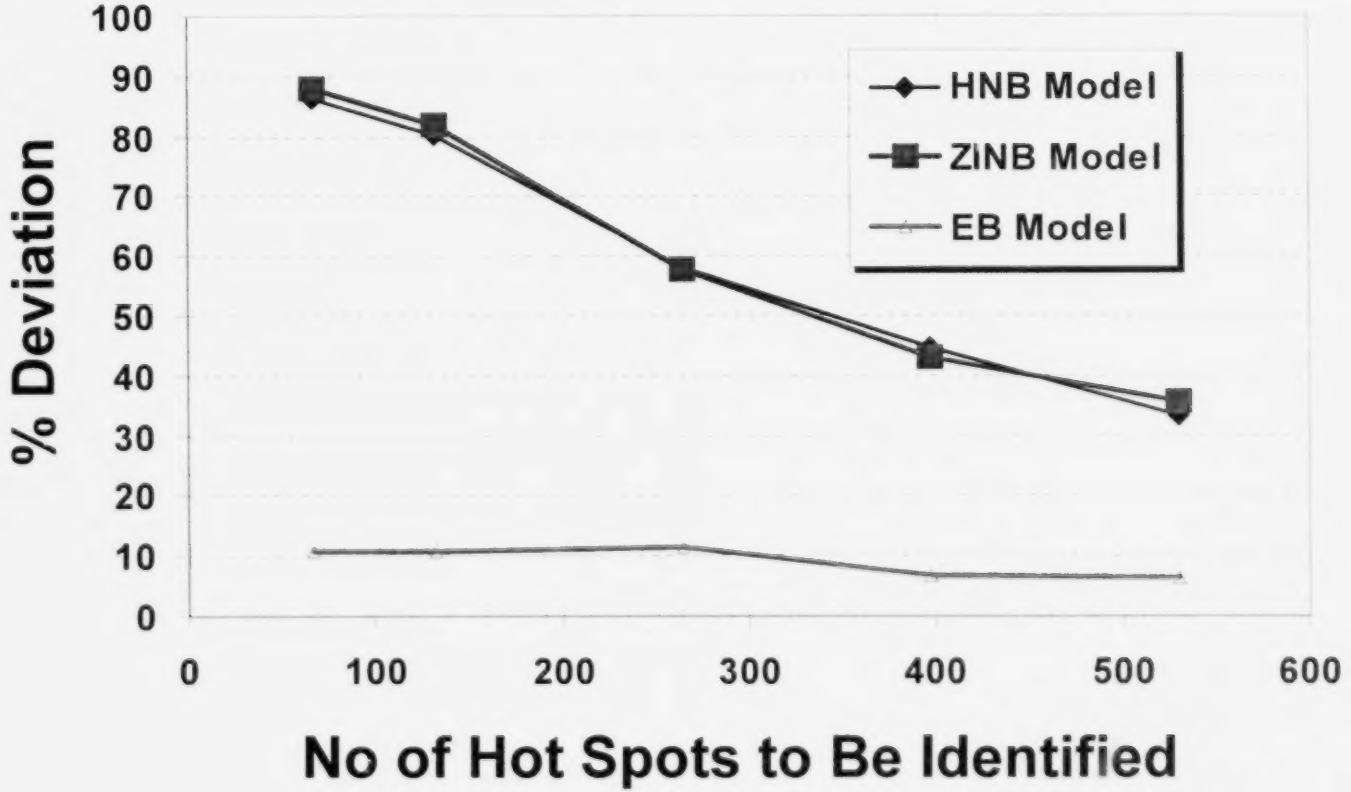
Issue III:

Which Method to Use for Hot Spot Identification?



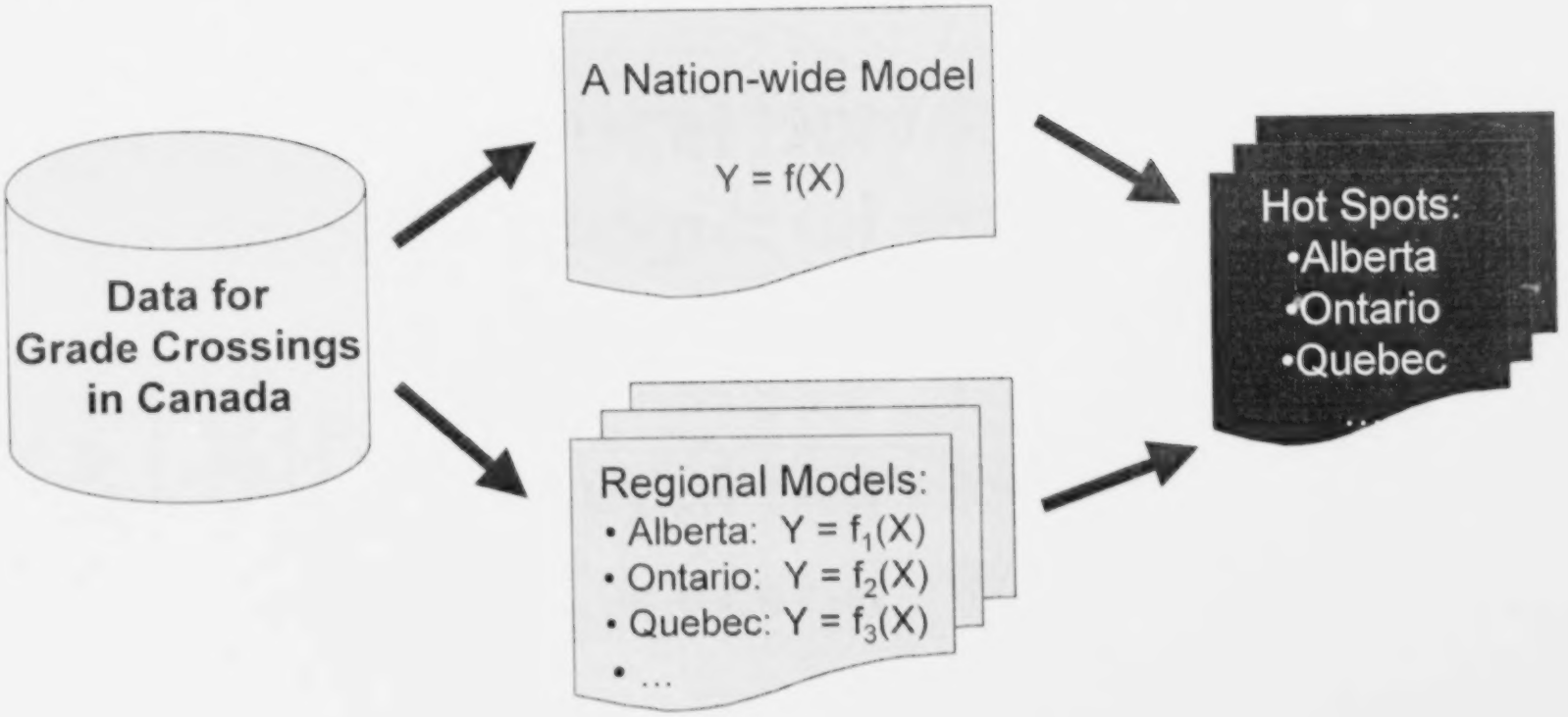
Practical Implication:

Different Methods - What Differences Do They Really Make?



Issue IV:

Geographical Scale: Nation-wide or Regional Model?



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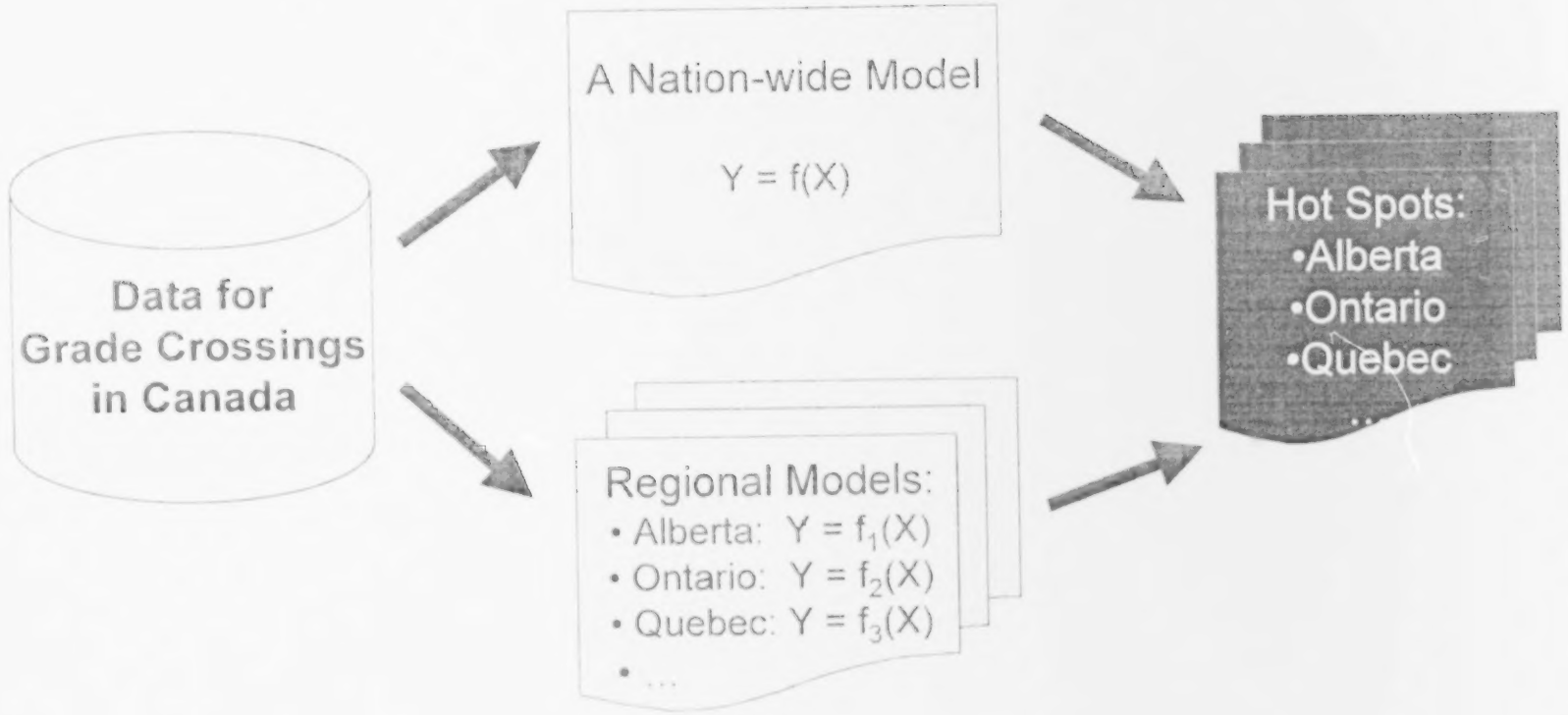

Practical Implication:

Nation-wide vs. Regional – An Example

- Crossings with *flash lights* in Ontario and Quebec
- Hot Spots based on a nation-wide model?
- Hot Spots based on a regional model?

Practical Implication:

Nation-wide vs. Regional – An Example

- Crossings with *flash lights* in Ontario and Quebec
- Hot Spots based on a nation-wide model?
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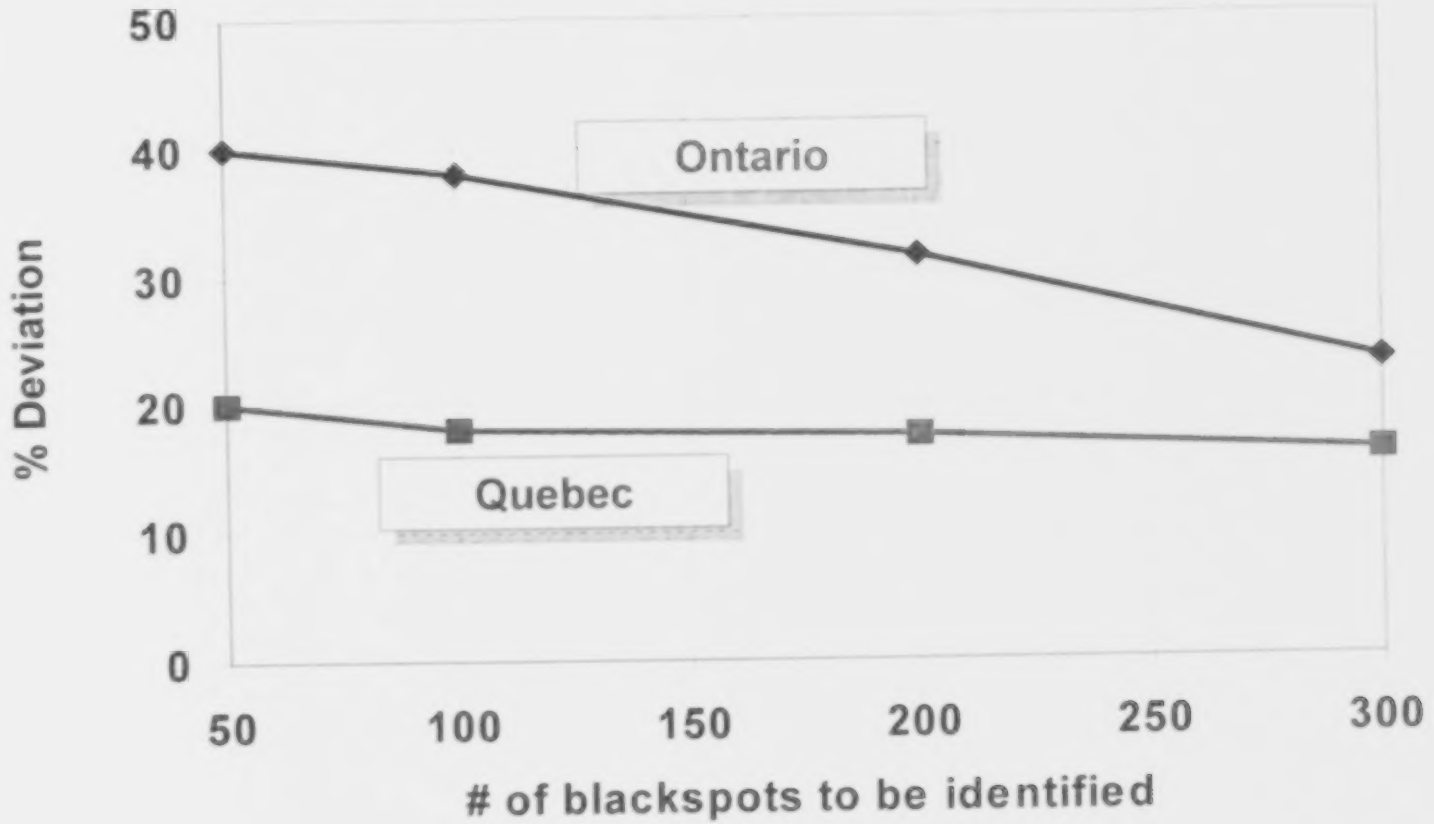
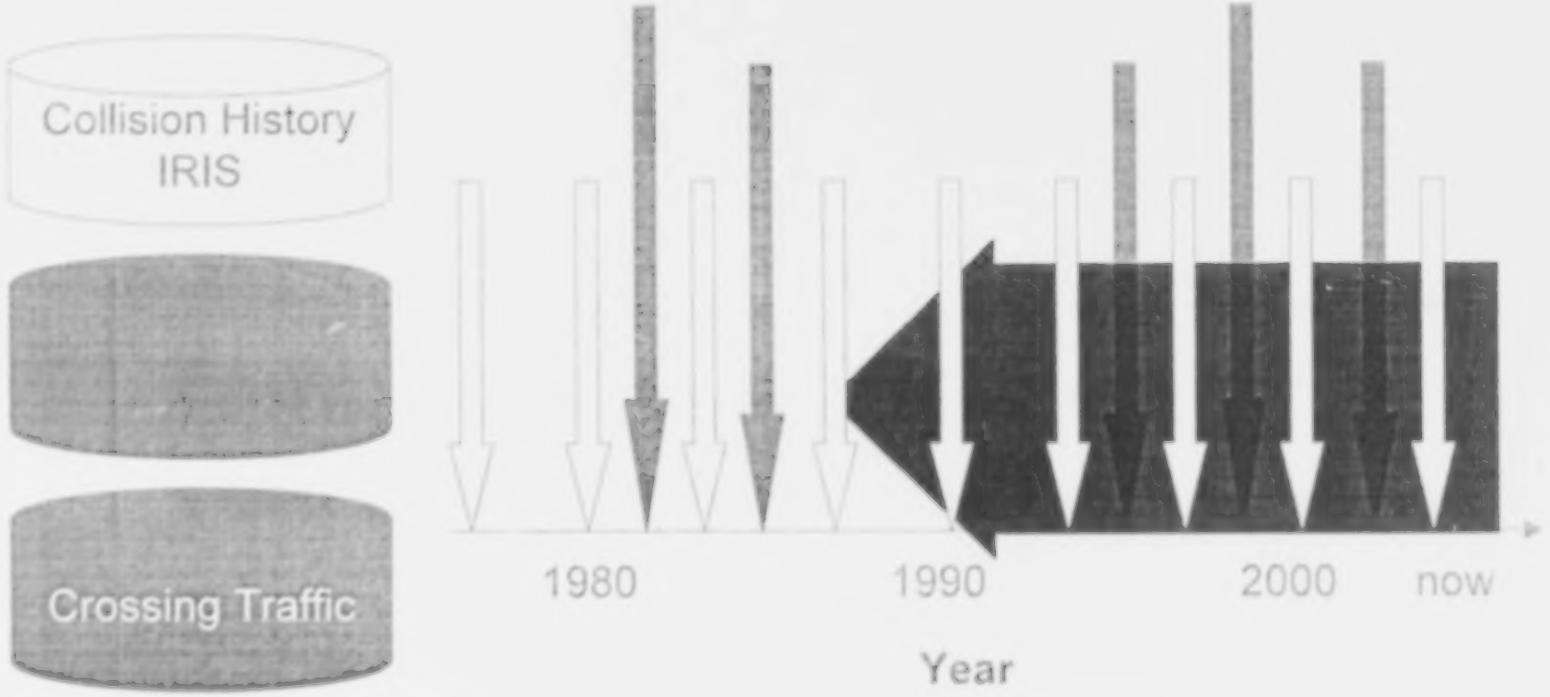
Difference in Hot Spot List



Issue V:

Temporal Scale: How Many Years of Data to Use?

Data Sources



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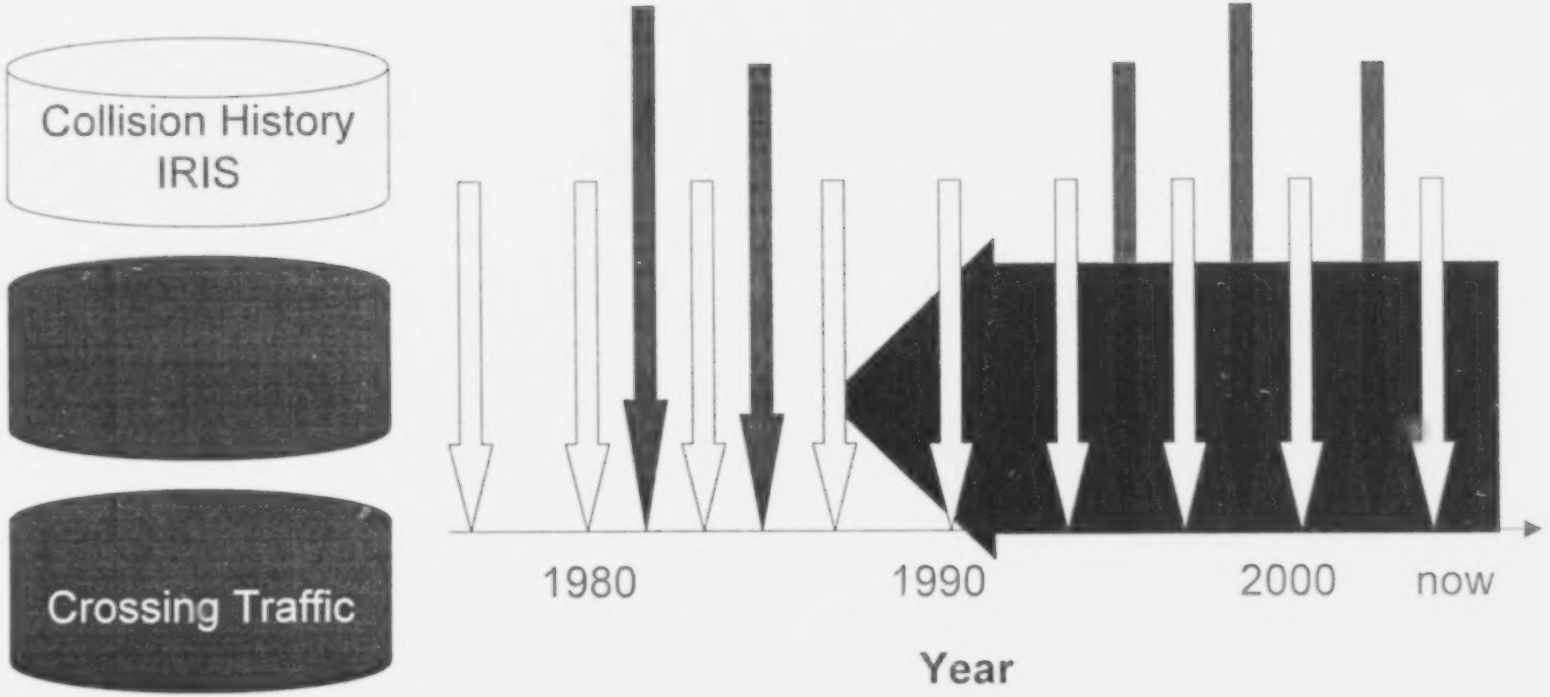


Problems with Using Data of a Long Period

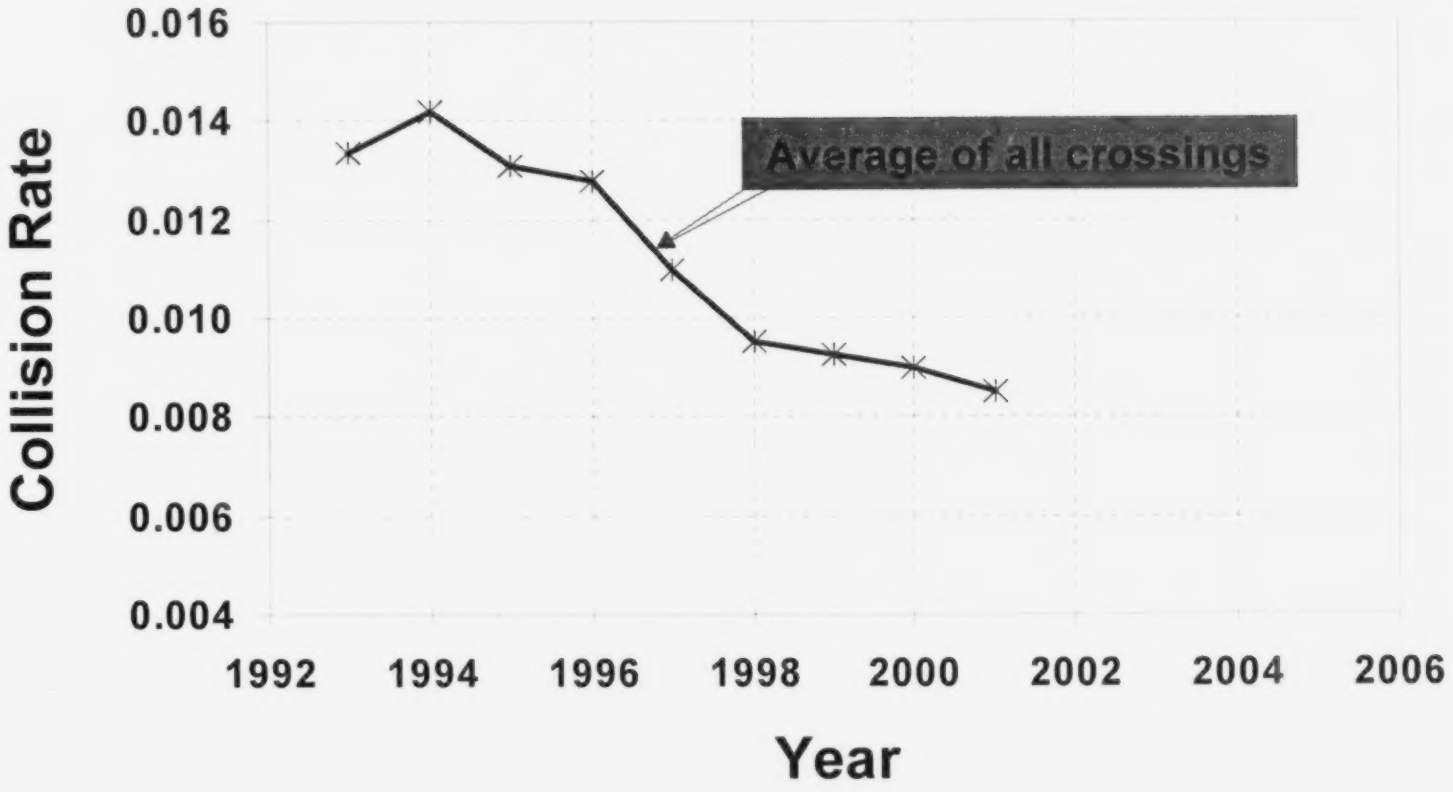
- **Crossing conditions** change over time, but are unobservable, e.g.:
  - Exposure?
  - Driver behaviour?

Problems with Using Data of a Short Period

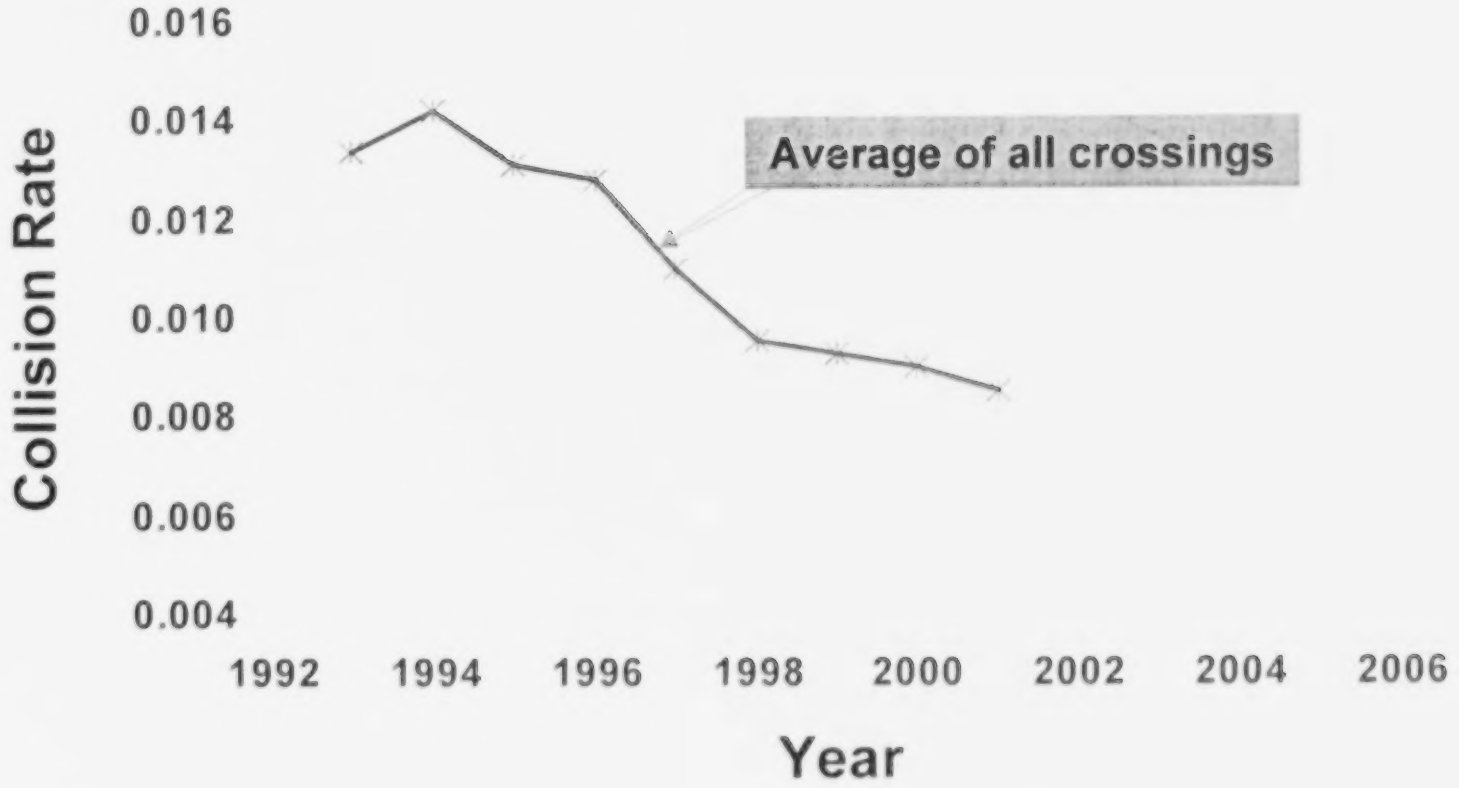
- ***Not enough observations*** for obtaining statistically reliable estimates

- ***Regression to the mean*** – may lead to over- or under-estimation

Collisions in Canada Are Decreasing!



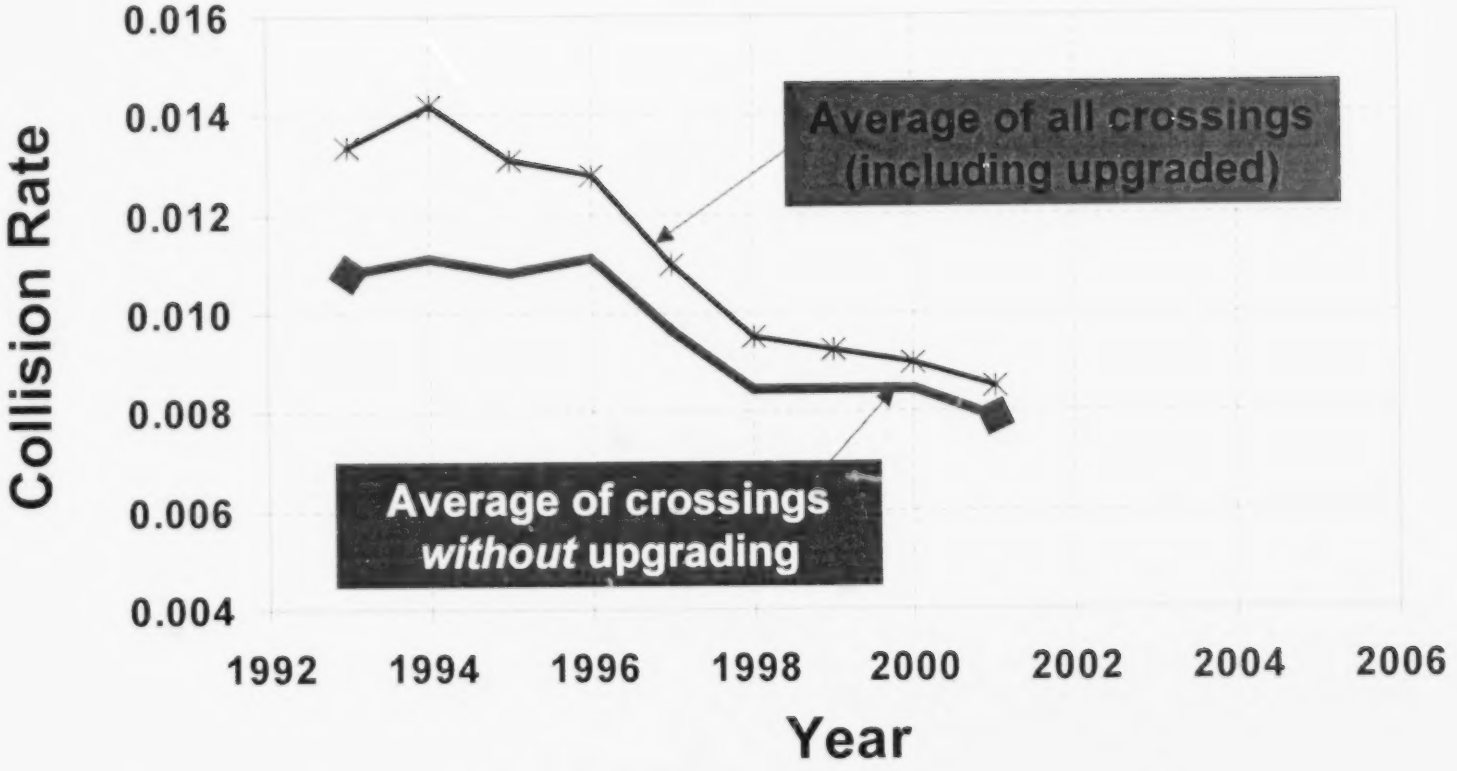
Collisions in Canada Are Decreasing!



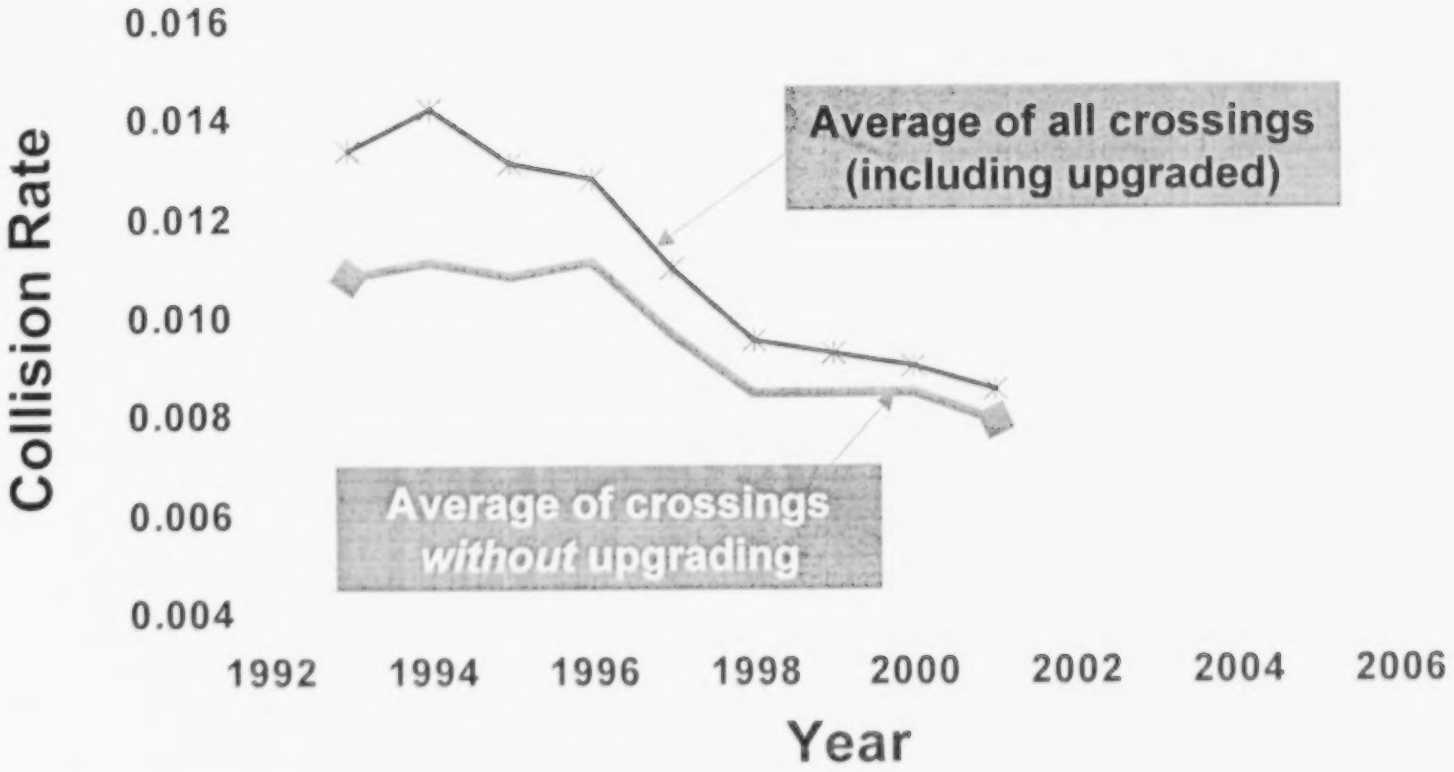
But, Why?

- Upgrading?
- Better awareness?
- Decreasing traffic?
- Others?

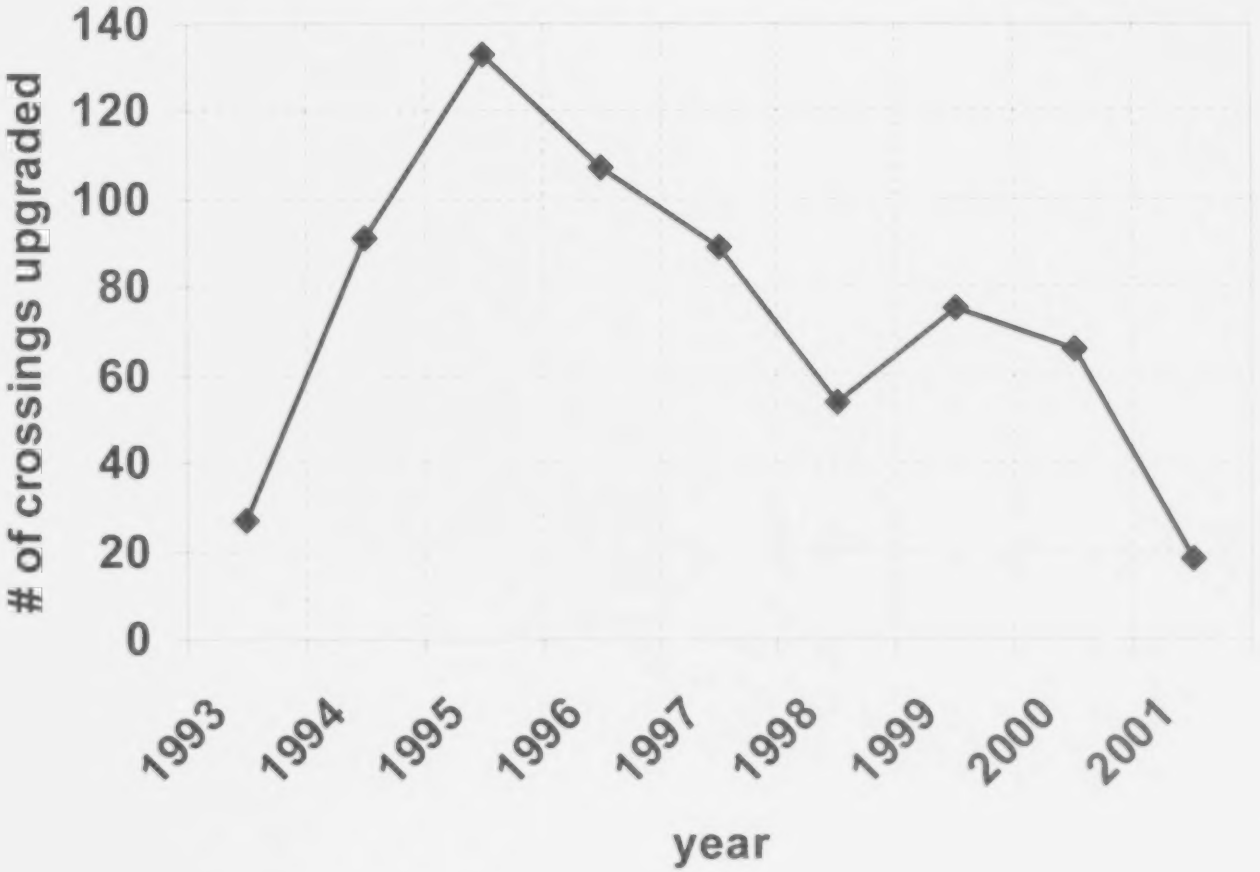
An Explanation



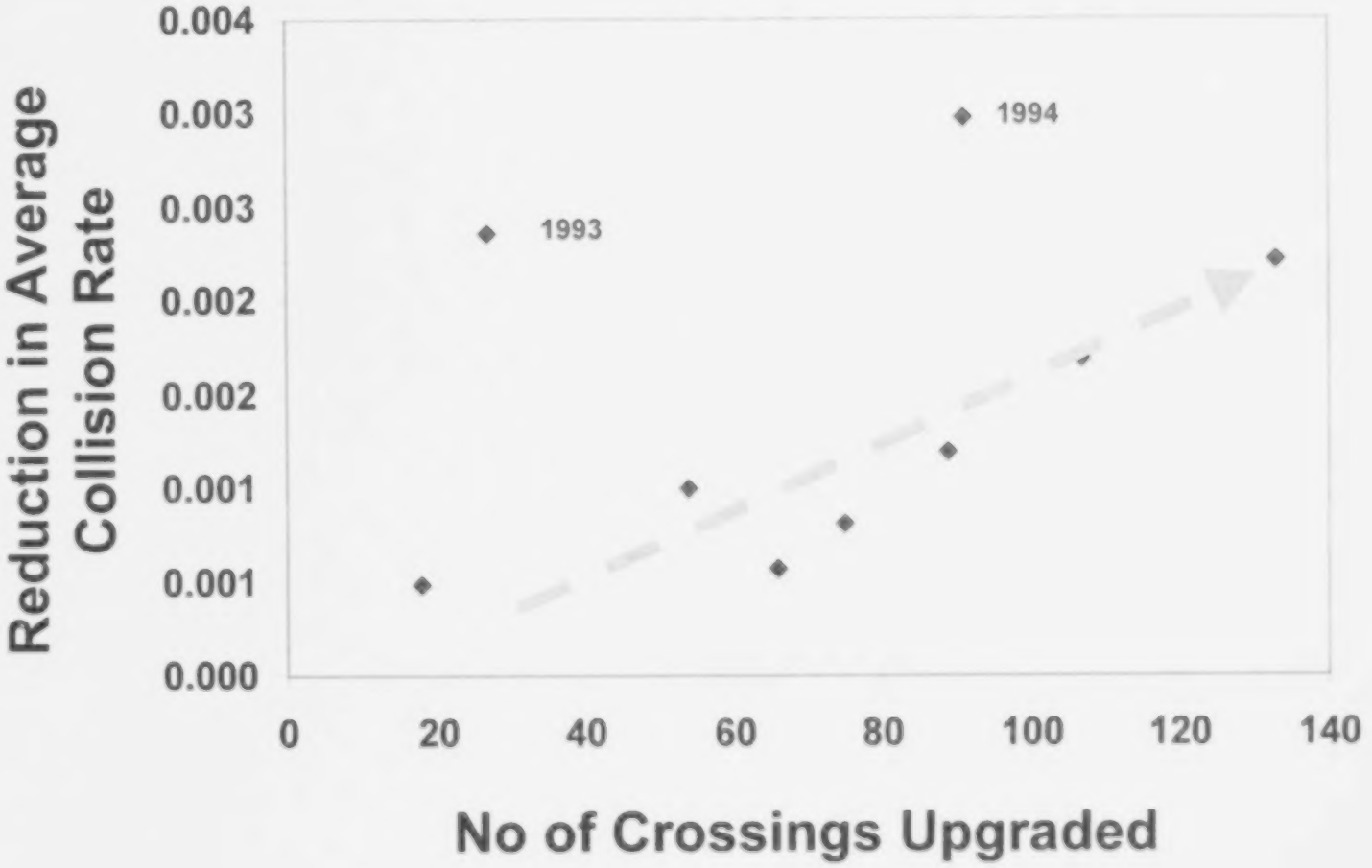
An Explanation



Grade Crossing Upgrading



Effect of Upgrading



If There Is a Trend

Then

- How many years of data to use?
- How to deal with trend?

Other Issues

- Absolute performance of various risk models?
- What ranking criteria to use?
  - Frequency, consequence, risk,
  - Potential for risk reduction?
  - B/C?
  - …

Concluding Remarks

,

Knowing there is uncertainty is strength,

…

- Lao Tzu (B.C. 600)

Acknowledgements

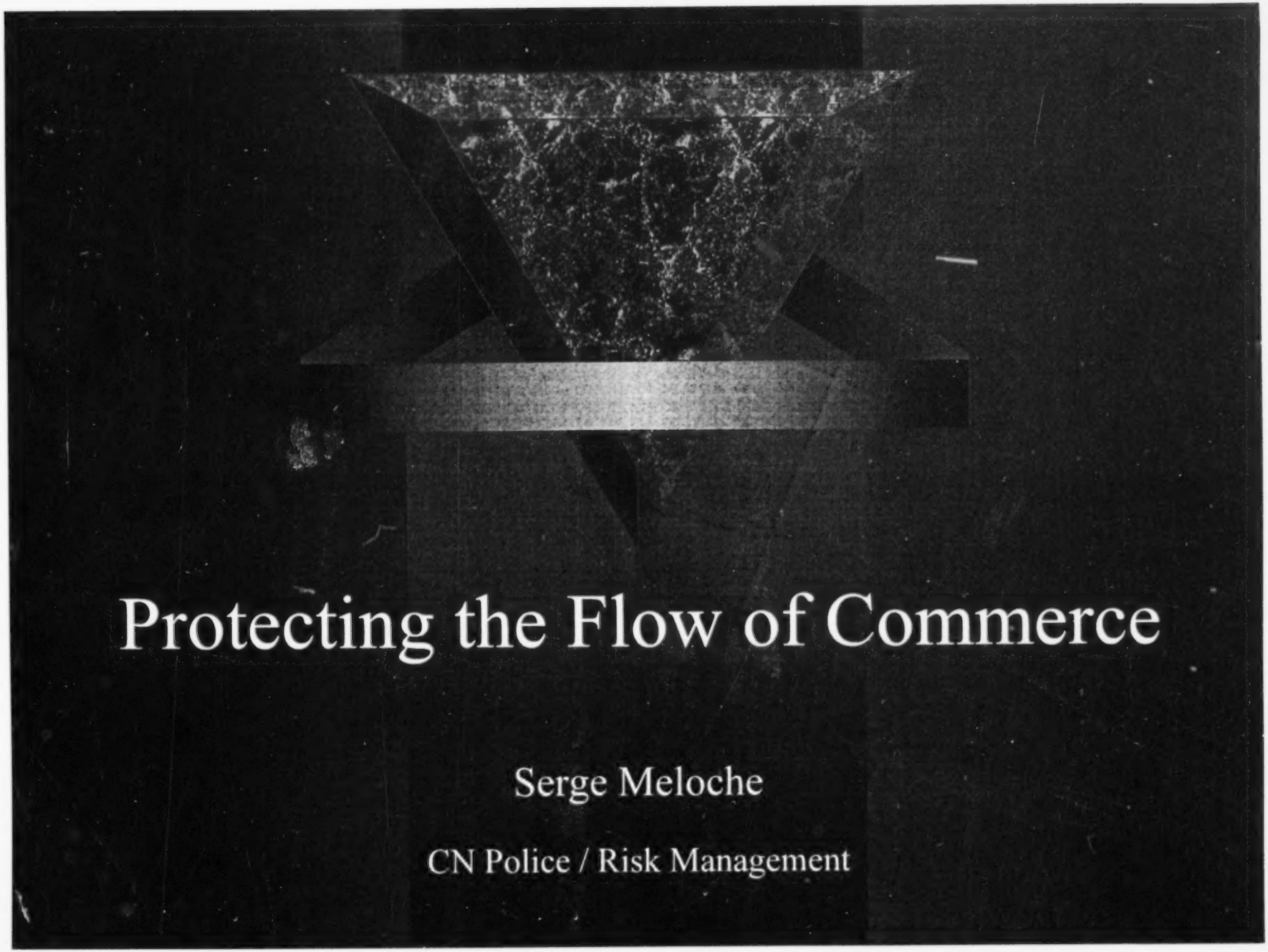
- Funding from Transport Canada
- Funding from NSERC
- Members of TDC and the Project Steering Committee
- Research team at UW
  - Prof. F.F. Saccomanno & Prof. L. Fu
  - Luis Mirand (PhD Candidate)
  - Peter Park (PhD Candidate)
  - David Lai (MASc, 2004)
  - Congming Ren (MASc, 2002)

Protecting the Flow of Commerce

Serge Meloche
Canadian National Railway, Montréal, Quebec, Canada

Abstract

Railway companies, in collaboration with Canadian and U.S. governments, communities, law enforcement agencies, and other key stakeholders, continue to work together to better safeguard and secure people, operations, and assets throughout the railway infrastructure. Operation Lifesaver and railway police play an important role in educating children, drivers, and others in communities on how to be safe near railway lines and grade crossings. Railway police continue to be vigilant against trespassing and other types of violations. Improving border and customs protection, developing vehicle and container inspection systems, enhancing IT security, implementing perimeter and access controls, and other strategies are also key components of the overall risk management process.

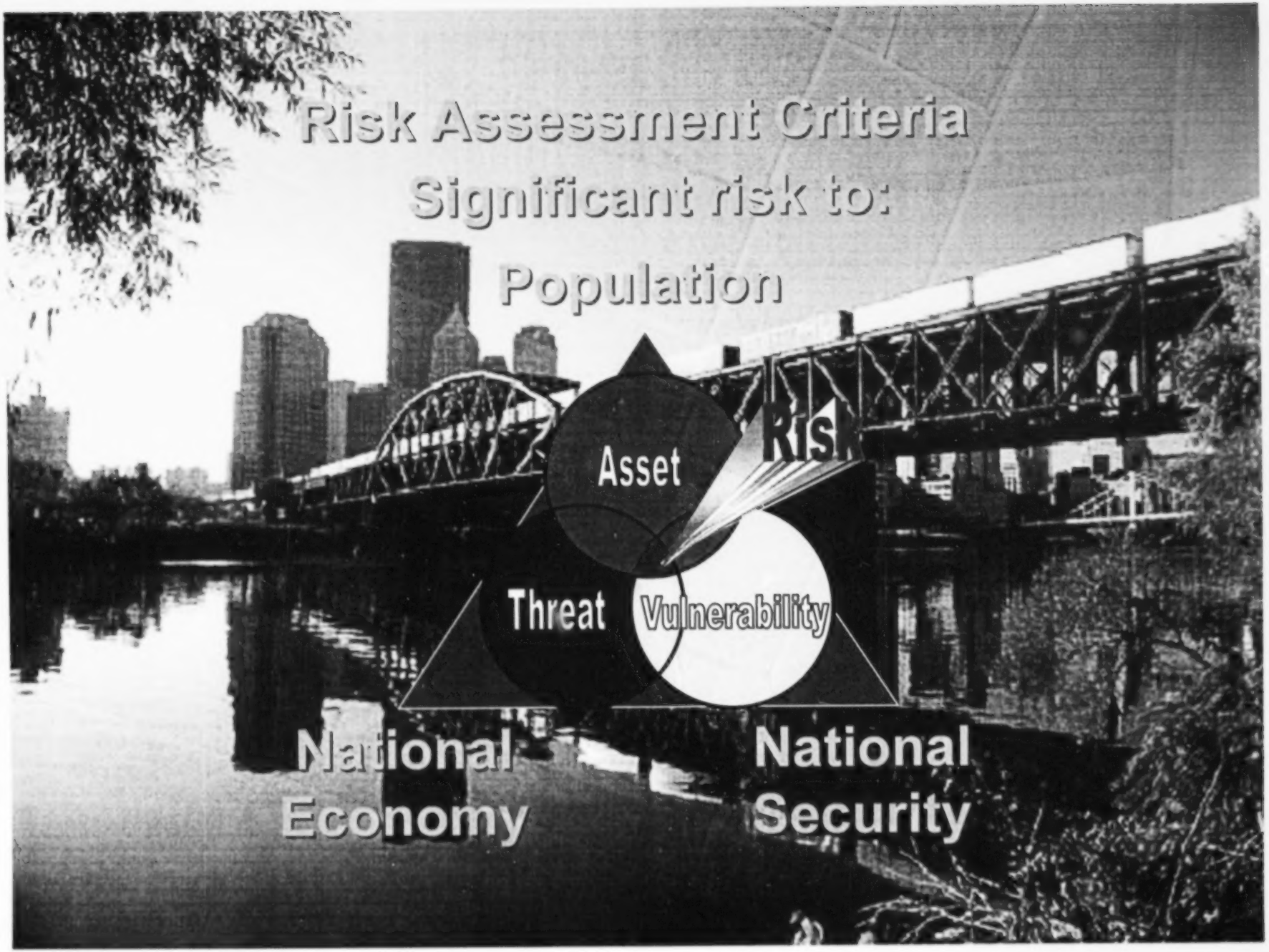


Protecting the Flow of Commerce

Serge Meloche

CN Police / Risk Management

Railroad Security Task Force Members


Risk Assessment Criteria
Significant risk to:
Population
Asset
Risk
Threat
Vulnerability
National Economy
National Security

Risk Assessment Criteria
Significant risk to:
Population
Asset
Risk
Threat
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National Economy
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Overview of the Plan

RESTRICTED INFORMATION
Railroad Security Task Force

Terrorism Risk Analysis and Security Management Plan

Prepared by the
Association of American Railroads
Railroad Security Task Force

February 1, 2002

EWA Information and Infrastructure Technologies, Inc.
13873 Park Center Road Suite 500
Herndon, Virginia 20171

The data in this report shall not be disclosed outside the Association of American Railroads and will not be duplicated, used, or disclosed in whole or in part for any purpose other than to improve the security of the people, processes, and technology of the transportation infrastructure of the United States.

RESTRICTED INFORMATION
Railroad Security Task Force

5 Critical Action Teams

- Hazardous Materials
- Operations
- Critical Infrastructure
- IT & Communications
- Military Liaison

AAR Rail Security Plan

- Alert Level 1 Normal Day-to-Day

- Alert Level 2 Heightened Security Awareness

- Alert Level 3 High Credible Threat

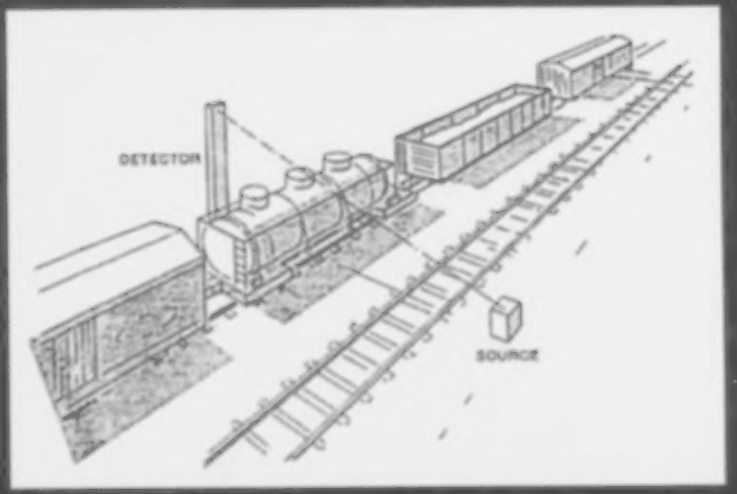
- Alert Level 4 Severe Confirmed Threat

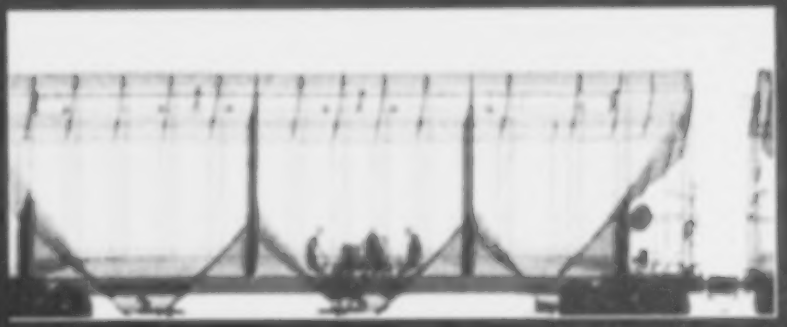
C-TPAT / PIP

- Customs – Trade Partnership Against Terrorism (C-TPAT), which is part of CBP (Customs Border Protection)
- Partners In Protection (PIP) – Canadian Border Services Agency
- CN was 1st Railroad in North America certified in C-TPAT and PIP
- On-site Validation Process

Railroad VACIS (Vehicle & Container Inspection System)

- Railroad car inspection system developed for CBP
- Able to scan railway cars moving at 5 mph
- Detects illegal aliens, weapons of mass destruction, and contraband
- Currently used at several ports to examine inbound OSM containers





VACIS Deployment on CN

- Ranier, MN (CN)
- Rouses Point, NY (CN/CP)
- Buffalo, NY (CN/CP/NS)
- Noyes, ND (CN/BNSF/CP)
- Sarnia / Port Huron (CN)
- Windsor / Detroit (CN, CP)*

* Soon to be operational

Legislative & Regulatory Fallout

- Canada-U.S. Smart Border Accord
- Department of Homeland Security / Public Safety & Emergency Preparedness
- Implementation of major customs security initiatives
- Customs targeting using advance electronic data & non-intrusive technology
- Added transborder complexities due to Bioterrorism Act of 2002

CN Canadian-U.S. Initiatives

- Strengthen partnership w/Canadian-U.S. Customs
- Joint Enforcement Details w/CBP
- Establish partnership w/U.S. CBP as a result of VACIS installation in Sarnia, Ontario
- Increase patrol at border by CN Police
- Improve frequency of interaction w/Transportation

Additional Investments in Security

- Perimeter & access controls for rail yards, bridges, tunnels & rail traffic control centres
- IT security enhancements
- Issuance of photo ID to 23,000+ employees
- Use of biometric technology at intermodal in-gate terminals

Risk Management – Protecting CN Beyond the Border

- Guided by our 5 Principals: People, Safety, Cost Control, Customer Service & Asset Utilization
- CN embraces the Risk Management process in protecting all areas of our operation
- CN Police protect CN employees, CN assets and our customers' property
- We have professionally trained and certified Police Officers in Canada & the U.S.
- CN and our employees are part of the communities we operate in and through

Police/Risk Management Initiatives

- Joint force operations and blitzes with local Police in 2003
  - Vehicle drivers charged 5,401
  - Vehicle drivers warned 2,908

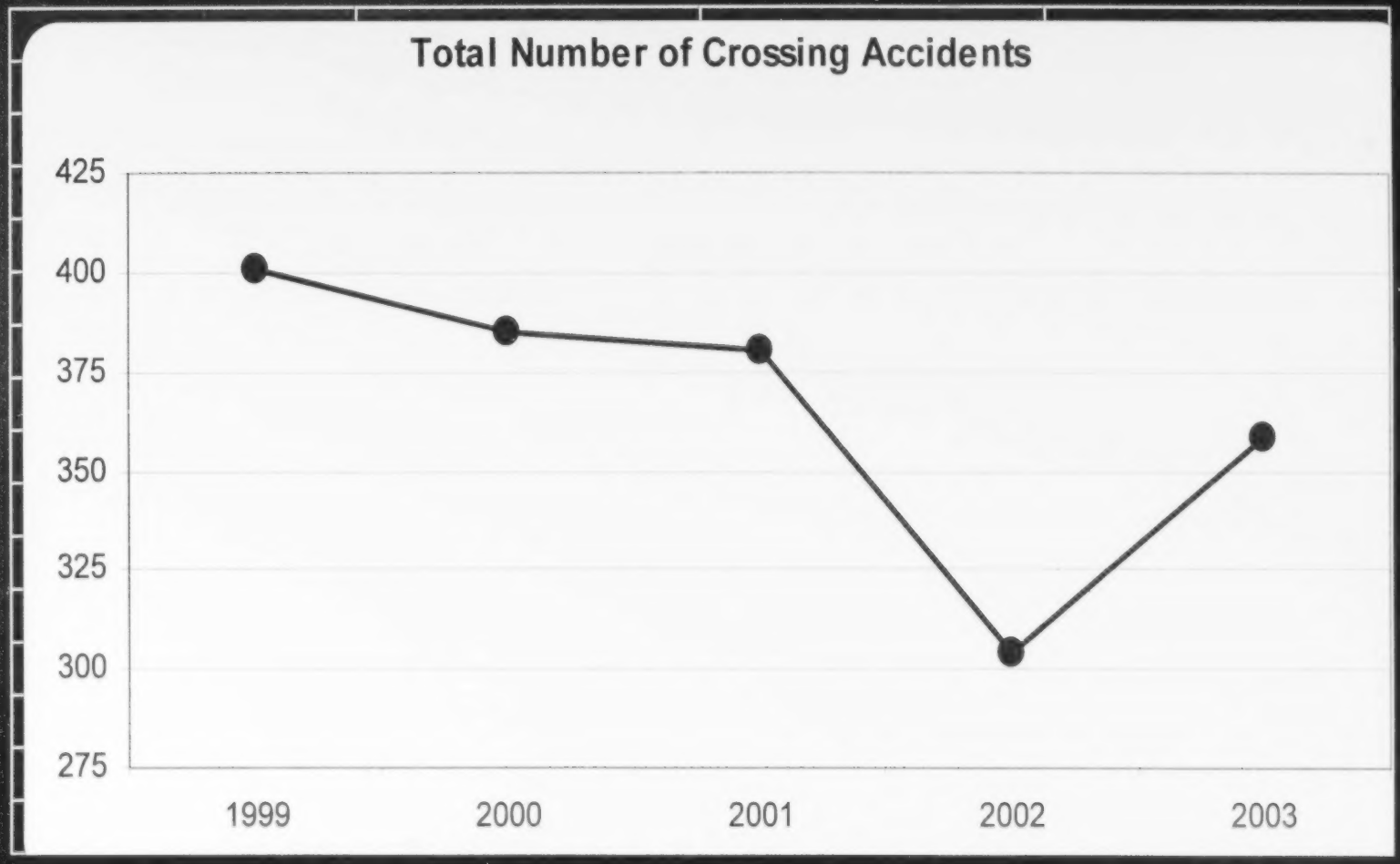
  - Trespassers charged 1,064
  - Trespassers warned 2,703

- Investigation of Near Crashes
- Implementation of the Rail Incident Investigation Guideline w/Law Enforcement Agencies

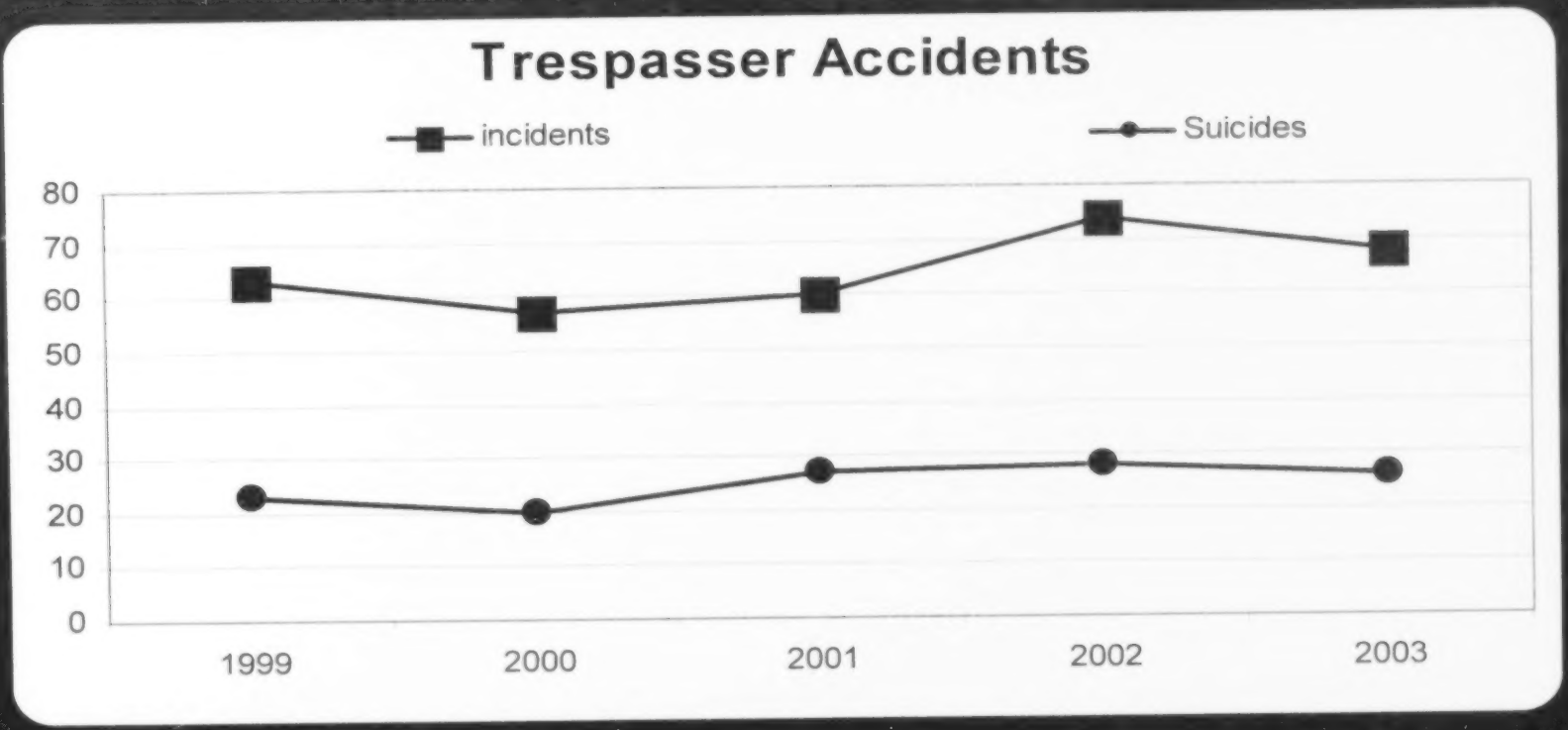
Police/Risk Management Community Education

- Operation Lifesaver Training & Education
  - Primary and High School
  - Bus and truck drivers
  - Driving schools
- Safe Communities Foundation
- Safe Kids Canada
- Community Trespass Prevention Guide
- SmartRisk

Grade Crossing Accidents



Trespasser Accidents



Thank You and.....
BE SAFE !

Day 2 Closing Comments

Gary Drouin
Rail Safety Directorate, Transport Canada, Ottawa, Ontario, Canada

Video 1 Video 2

What a success...

Year after year we get more participants than the previous year. Not only are the participants increasing, the diversity has also expanded from the first workshop held. Participants from provincial and municipal authorities, other federal departments, safety organizations, researchers, suppliers, and of course the rail industry. U.S. participation keeps on growing, and this year, UK participation. The workshop is truly becoming an international "get together" on rail safety research.

I'd like to thank the great efforts invested by the organization committee, the technical support, the interpretation, and of course the volunteers. Thank you to all participants...and a very special "Thank you" to Minister Lapierre, Minister of Transport, for his continuous support of the program and ensuring the financial contributions to Direction 2006 are available. Thank you to

the partners who invest in the 1/20 program...that is for every dollar Transport Canada provides, our partners contribute $20 either in cash or in-kind services. And of course, thank you to the researchers.

Direction 2006 Stats

The level of awareness of grade crossing safety and trespassing prevention has never been so high. D2006 is used as a benchmark for other TC programs.

Direction 2006 survived major budget cuts in TC in the past several years, in particular last year. Another benchmark on the Minister's commitment to Direction 2006.

The base groups that are involved in Direction 2006 have also evolved: Safe Kids Canada, universities, provincial and municipal authorities, suppliers, VIACOM, professional sports figures, and many more.

Other measures of success beside the stats are:

- Change in human behaviour. Result — a decrease in crossing collision and trespassing incidents.
- Change of behaviour in relationships in rail-related groups (regulator-railway, safety groups, management-unions, private sector other than rail such as VIACOM, different levels of law enforcement working together, different countries such as Canada-US-UK...)

Is Direction 2006 successful?

I have a prejudice so my evaluation could be questionable. I'll let you give the answer to this question.

Another measure is the elimination of the silo effect. Research works hand in hand with evaluation, communications, law enforcement, resources...all the partners come together and work together in partnership for one common goal: safety.

I cannot present each of the activities within each KRA, as time does not allow. What I can say is the each KRA has a tremendous positive report card.

I do want to mention that Direction 2006 is not only having an impact on rail safety in Canada. Transport Canada Grade Crossing Improvement funds, the initiatives taken by the rail industry, safety groups such as Operation Lifesaver and many more all contribute to the success.

But the strongest point of all is PARTNERSHIP. It is the foremost key point in the success.

The second thing I'd like to talk about is the 9th International Level Crossing Safety and Trespass Prevention Symposium to be held in Montréal, September 10-14, 2006.

Presentation to Bob Nash

All good things come to an end. When a member of your family leaves home for university or a new job, you feel sad yet happy for the person. Today we have a leader leaving Direction 2006. Bob Nash received a promotion in the IT section at CPR (the future CEO of CPR...so be very nice to Bob!!!!!).

What has Bob brought to Direction 2006?

- Structure and a functional research program.
- Balance between requirement of government, industry and even within the rail industry.
- He ensured the Research KRA focussed on "what was needed to achieve the 50% target" and not "what would be nice" for research.
- He brought credibility to the research KRA, not only in Canada, but also in other countries.
- He managed to involve all parties and have them think outside the box.
- Professional in his management style.
- Courteous with colleagues.
- Motivator in keeping research going.
- A great contributor on the Executive Committee of D2006.
- Always in a good mood...just a great person to be with.

Bob, on behalf of Direction 2006, the Research KRA and hundreds of Canadians whose lives have been saved or are going to be saved by your commitment to rail safety, I'd like to present you with this plaque.

Workshop Wrap-Up

Robert Nash
Signals and Communications, Canadian Pacific Railway, Calgary, Alberta, Canada

I would like to reflect for a few moments over the last day and a half. I was truly impressed with the quality of the presentations and the presenters, the sharing of information at the roundtable theme discussions, and especially with the quality and professionalism of you, our stakeholders, in making the workshop a true success.

I trust you will agree with me that we did meet our overall workshop objectives set out yesterday morning, which were to:

1. provide you with an update on the results of the Research KRA's activities this past year;
2. provide you with an opportunity to hear about other research going on in the industry;
3. hear what our U.S. neighbours to the south are doing in terms of highway-railway grade crossing and trespassing research; and

4. provide you with an opportunity to input into future research activities through four interactive theme discussions.

I also stated that true success would only be reflected by seeing the research results put into action, and by so doing, we will see the numbers of highway-railway grade crossing accidents and trespassing incidents reduced.

I believe you are all passionate about sharing in this goal, and it will take all of us doing our part to achieve it once we leave here today.

Proceedings of this workshop will be sent to all participants early in the new year. The proceedings will be produced on a CD.

We will also be soliciting your feedback on the workshop through an on-line survey. You will be sent further information on this via e-mail.

The Research KRA Steering Committee members will be meeting after the close of this workshop. The meeting is only for the steering committee members and will be held here at the Delta in the Bonsecours Meeting Room.

I would again like to take this opportunity to recognize all of our sponsors this year, including:

· 3M
· Quixote

- PHW
- GELcore
- Carmanah Technologies
- CPR
- CN
- VIA
- Operation Lifesaver
- D2006

for their generosity and support of the workshop through funding of last evening's reception, the raffle prizes and the presenters' gifts.

I would also be remiss if I did not recognize all those who made this workshop possible. As you can imagine, an event of this size takes considerable planning and effort.

Our three moderators were:

- Paul Lemay — TDC
- Ron Mitchell — TC Rail Safety
- Phil Poichuk — TC Rail Safety

Our facilitators were:

- Frank Lalonde — TC Rail Safety
- François Cournoyer — TC Rail Safety
- Pierre Mayer — TC Rail Safety
- Martin Bélanger — TC Rail Safety

Our planning and preparation group consisted of:

- Anthony Napoli
- Paul Lemay
- Luc Nadon
- Barbara Poole

Those who volunteered to help run the workshop included:

- Barbara Poole — working the reception area
- Luc Nadon — working the reception area
- Sandler Pierre-Paul — laptop presentation support

Other TDC Communications and support staff who provided excellent service during the planning of the workshop were:

- Kevin Crombie
- Josée Valcourt
- André Boudreau
- Dina Iwanycky
- Ginette Lessard
- Daniel Tamaro

And thank you to everyone else that I might have missed!

We plan on holding our Seventh Annual Workshop on Highway-Railway Grade Crossing

Research next year about the same time of year. You will be notified of the details in the new year. We look forward to seeing you then.

On behalf of the Research KRA and Direction 2006, I would like to thank you all for coming, ask that you travel safely as you head home, and to do your part to promote railway safety.

Thank you.

Sixth Annual Workshop on
Highway-Railway Grade Crossing Research

A D2006 INITIATIVE

Roundtable Discussions

OBJECTIVES

The primary purpose of the roundtable discussion is to identify research and development (R&D) ideas – technologies, methodologies, etc. – and to get feedback and direction on current and future research initiatives. The results of these discussions are used to define new R&D projects and realign those that are ongoing. The overall research effort is intended to provide options for increasing safety (reducing accidents, injuries, and fatalities) and improving the cost-effectiveness of highway-railway grade crossing systems.

Theme 1: Stop and Yield Sign at Passive Grade Crossings

Facilitators: Peter Mayer — Cartier Meeting Room
François Cournoyer — Vitré Meeting Room

There is a proposal in the U.S. for the *Manual on Uniform Traffic Control Devices* (MUTCD) to require installation of a stop sign or a yield sign on the same post as the crossing sign at every passive crossing. In this regard, is the standard crossing sign still useful or only a secondary symbol? Some may say that it should simply be replaced by a yield or stop sign with a tab indicating that the intersecting road is actually a railway track. Considering that numerous research reports show that a high percentage of motorists fail to comprehend the crossing sign, it might be more effective just to replace it with a yield sign. After all, the intended message to motorists approaching a passive crossing is to prepare to yield the right of way to an approaching train. As the yield sign is understood by nearly all motorists, this would eliminate a potential safety problem.

Key suggestions raised by the roundtable discussion participants:

1. Stop and yield signs with the crossing sign would be an effective warning sign. Many interpret the crossing sign as simply indicating the presence of a grade crossing. A stop or yield sign provide a clear instruction that all drivers are accustomed to.

2. Depending on the conditions associated with each passive grade crossing (e.g., visibility, sight lines, geometry), instructional signs should be installed with the crossing sign. An example would be "Restricted" signs for farm and private grade crossings.

3. The federal government should be the authority in developing criteria for the design and implementation of stop and yield signs, as well as selecting candidate grade crossings.

4. Once these signs are developed and criteria for design and installation established, they should be covered in TAC as well as in the driver's handbook.

5. Railway companies should be responsible for installing these signs at grade crossings.

6. A yield sign may not be interpreted the same by all on the approach of a grade crossing. Also, a yield and stop sign together at a grade crossing may be giving conflicting instructions, and may be considered a contradiction for some. A yield and a crossing sign together may also be giving conflicting instructions.

7. Research should be carried out to evaluate the safety merits of the yield and stop signs.

Theme 2: Eye Tracking Behaviour

Facilitators: Frank Lalonde — Versailles Meeting Room
Martin Boulanger — Verrière Meeting Room

A major preoccupation in the design of grade crossing systems involves identifying the most effective means of alerting motorists and pedestrians of an upcoming grade crossing and of an approaching train. The alerting capability of grade crossing warning systems must be reliable for the range of lighting and environmental conditions encountered at a specific location, and must be done sufficiently in advance of the crossing.

Examining visual behaviour and perception-reaction processes of motorists and pedestrians on the approach and while travelling over crossings of various designs and under different environmental conditions is key to help assess the effectiveness of current railway signs and determine whether some of them need to be redefined, redesigned, relocated, or eliminated.

Key suggestions raised by the roundtable discussion participants:

1. There are a number of challenges impeding effective conspicuity:
    - For some grade crossings, information overload from too many signs, or in an area that is visually busy, can impede effective conspicuity.
    - Environmental conditions such as sun glare and twilight can impede effective conspicuity.
    - There is a misunderstanding of what signs really mean. People interpret the crossing sign in different ways. Some believe the flashing red lights mean that drivers and pedestrians should stop until after the train clears the crossing area. Others believe the flashing red lights mean to stop, look and proceed. This confusion encourages inappropriate visual behaviour.

2. Some key human factors that affect visual behaviour and conspicuity:
    - People get very used to driving over the same crossing, most times with no train arriving. Over time these people are conditioned to believe that there is little chance a train is arriving as they are on the approach.
    - There are studies to support the phenomenon of underestimating the time of train arrival at a crossing, as well as underestimating the time required by the motorist to cross over the grade crossing.

- It is sometimes impossible to see a second train arriving because it is hidden behind the first train.
- Stress, fatigue, worries, and other physiological conditions will affect visual behaviour and conspicuity.

3. Additional safety measures that could be considered to facilitate appropriate visual behaviour include the introduction of a red-yellow-green lighting system. ITS can also provide a wider array of solutions for more effective or precise instructional signage.

4. Studies show that LEDs and their very wide beam pattern are more conspicuous than incandescence. LEDs should be installed as quickly as possible.

Theme 3: Provision of Adequate Warning at Grade Crossings

Facilitators: Peter Mayer — Cartier Meeting Room
François Cournoyer — Vitré Meeting Room

Given that highway traffic must yield to train traffic if adequate warning is provided, would highway departments be more qualified than the railways to define and review what type of protection is required at a grade crossing (type of warning system, signage, innovative type of protecting highway traffic) to adequately warn highway users? Similarly, urban centres are growing and spreading around railway properties, creating potential safety and trespassing problems at grade crossings and along railway tracks. Would municipalities have a better understanding of potential railway safety issues on their territories and of the most appropriate warning system to provide motorists and pedestrians in order to address specific problem areas?

Key suggestions raised by the roundtable discussion participants:

1. Road and municipal authorities should play a much larger role in the preparation of standards, as well as in the design and installation of advance warning systems at grade crossings.

2. Federal government should promote more involvement by road and municipal authorities in the preparation of standards for warning systems at grade crossings.

3. Grade crossings should have traffic lighting system similar to road intersections; i.e., green-yellow-red lighting sequence.

4. Failure of flashing lights and bell system results in inadequate warning. For example, drivers would not know how much time they have to clear the crossing before the train arrives. Also, a non-functioning red light has no specific meaning and would be interpreted differently by each driver and pedestrian.

5. A yellow background would make grade crossing occupants more cautious, especially in the case of non-functioning red lights.

6. Railway companies are responsible for safety on the right of way. Therefore, they should be responsible for deciding on the types of warning systems on railway property. However, road authorities, municipalities, and others should participate in the process of defining warning systems. A standardized evaluation program or process involving

railway companies, road authorities, municipalities, and others would be ideal in identifying appropriate warning systems.

Theme 4: Suicide

Facilitators: Frank Lalonde — Versailles Meeting Room
Martin Boulanger — St. Charles Meeting Room

The phenomenon of "suicide by train" is happening all over the world on an alarming scale. Railway companies and governments cannot tackle alone the socio-economic and personal problems that may underlie these suicide rates. To mitigate the problem, many will say, "fence the right-of-way." Others favour education and prevention programs. Solutions are not easy to find, as the problem is complex and difficult to analyse and quantify. The root causes of suicide by train and the risk factors have to be understood in order to identify practical solutions. Understanding the problem and identifying practical solutions will also help all railway stakeholders to define their role and responsibilities regarding this issue and to tailor specific solutions to their needs.

Key suggestions raised by the roundtable discussion participants:

1. German studies show that talking about the problem of suicide in the media increases the number of suicides. This curbs any initiative to debate the issue of suicide prevention in public.

2. Incident reporting does not allow for the identification of suicides as the probable cause. Therefore, it is very difficult to collect data on suicide-related accidents. Locomotive engineers and train-mounted video cameras could provide valuable information on potential suicides and their behaviour.

3. When trespassers are apprehended, enforcement officers could have a questionnaire that may help flag potential suicides. A follow-up of these individuals may help prevent future suicide attempts and encourage them to seek professional help. Answers provided during questioning should be captured as data.

4. In addition to identifying solutions that could prevent suicides from occurring on railway property, railway companies and other key stakeholders should be part of the process of finding ways of reducing suicides overall. Some of the key stakeholders with which railway companies could partner include suicide prevention organizations, hospitals, schools, governments, clergy, and enforcement officials.

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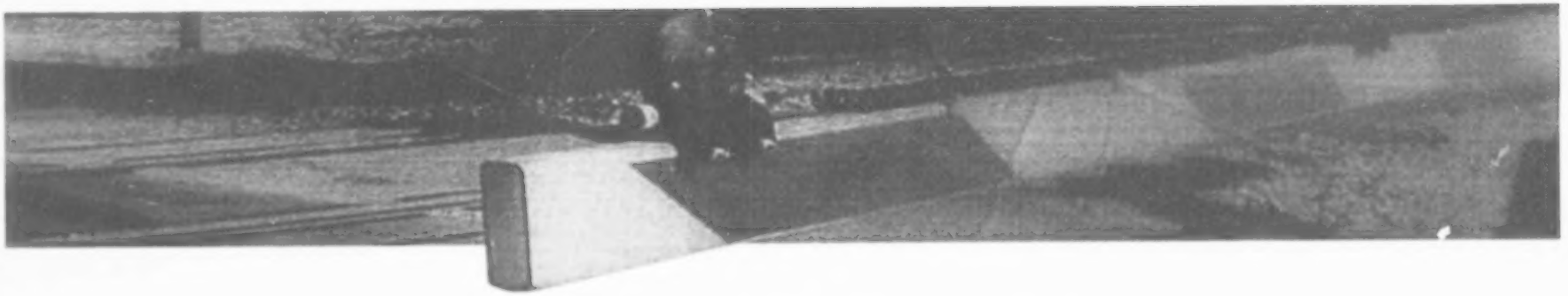

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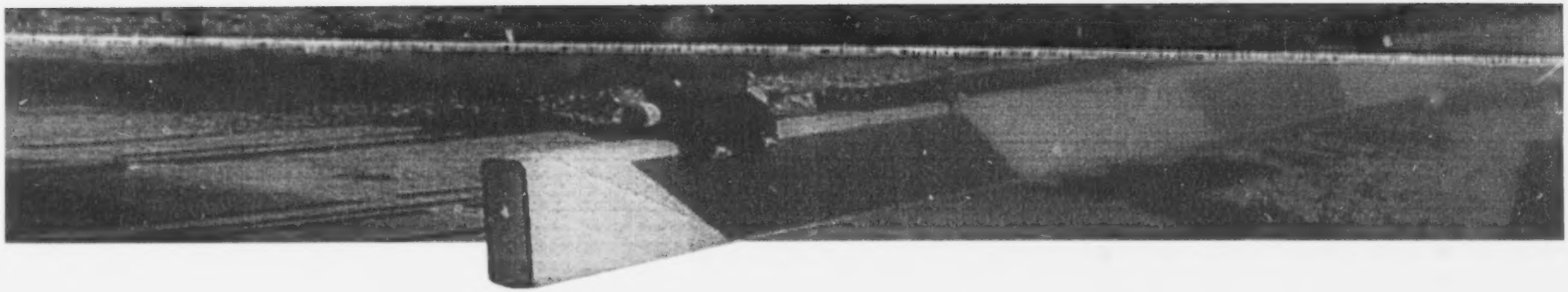

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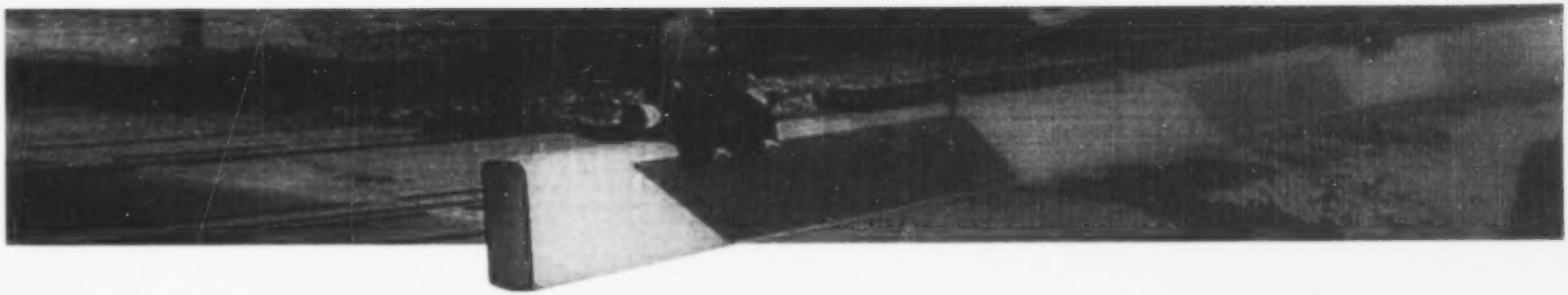

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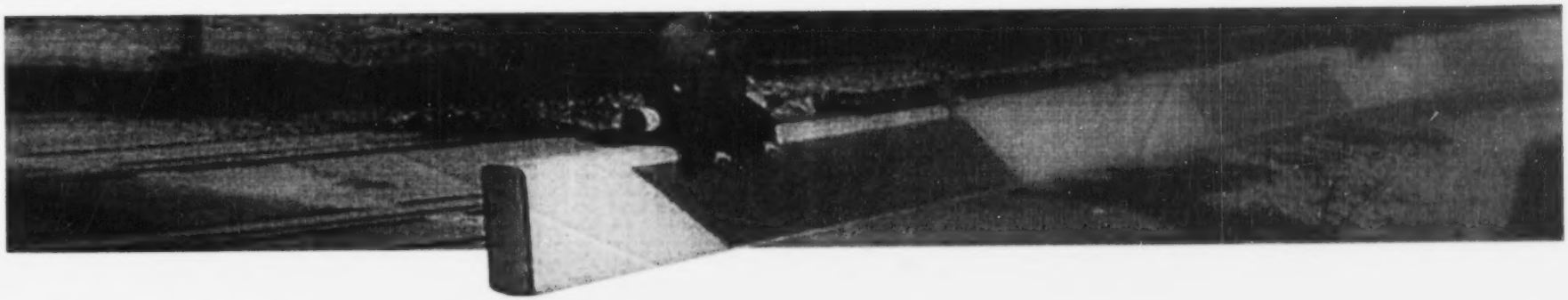

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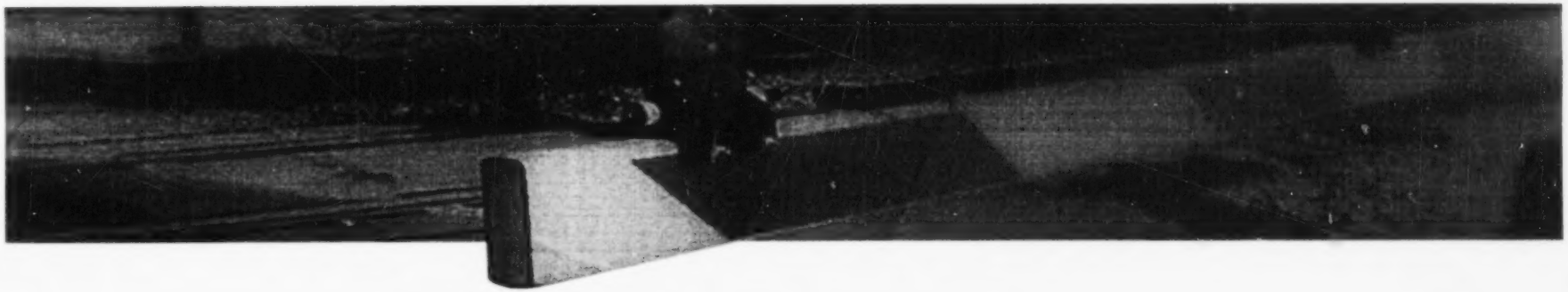

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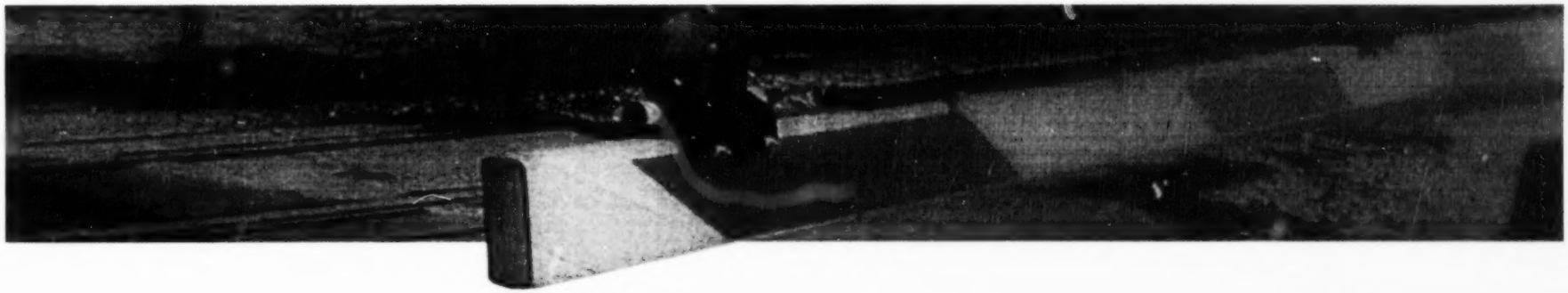

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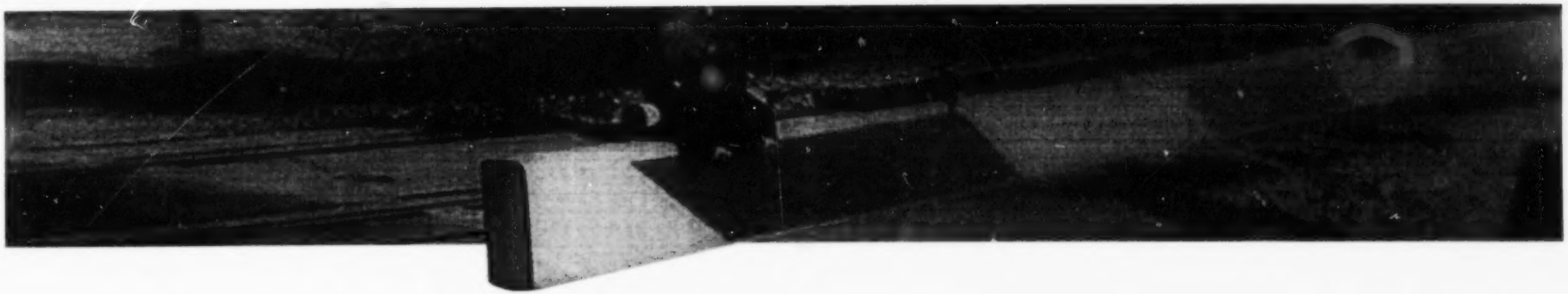

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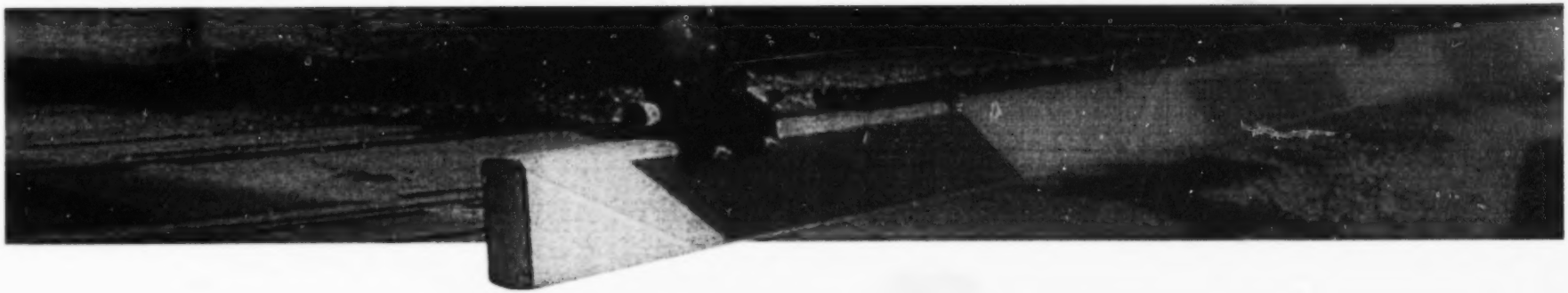

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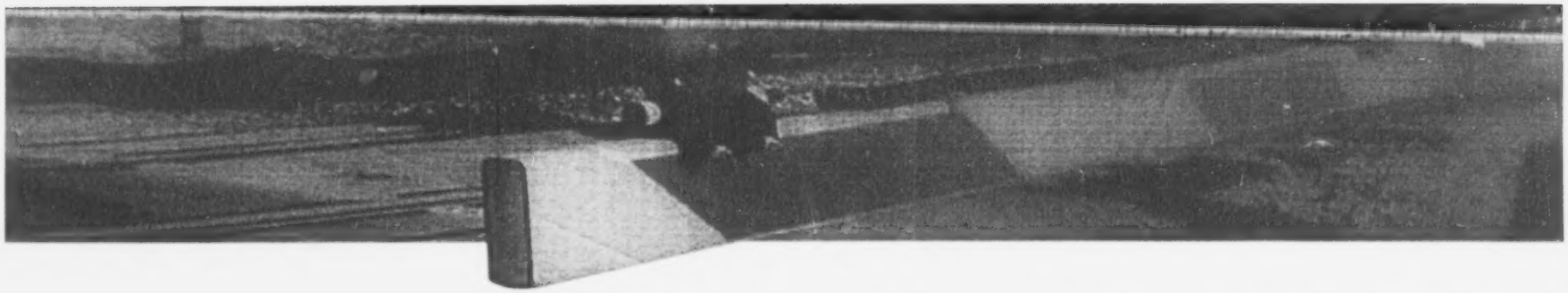

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